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EDITORIAL NOTES—GAS, &c.

The Good that a Man Does ——.

UNDER the shadow and the protection of the walls of the offices of the South Metropolitan Gas Company to-day and henceforth stands a monument, erected by those with whom and for whom he immediately laboured, to the memory of Sir George Livesey. A better site for it could not have been chosen than one so closely identified with the conceptions, the developments, and the ultimate successes of the schemes and policies which, from conception to success, were surrounded and guarded by the purest ideals and the strongest motives. The statue now standing there, life like, faces all who enter the well-known works with, depicted in features and attitude, that characteristic consciousness of right with which the living original faced the world, and which largely gained for him that confidence which made him a leader among men. It was a notable gathering of intimates and friends of Sir George whom the Chairman of the Company (Mr. Charles Carpenter) and his fellow-Directors invited to be present on Friday afternoon at the unveiling of the statue by the Right Hon. Earl Grey. The "intimates and friends" present—such was the affection for the man to whose memory this honour was being done—extended the full length of the social scale, from peer to hand labourer. They were there, without social distinction, in common sympathy and recognition. The occasion and the scene were, backed by many memories, inspiring.

The cynic says that it matters but little what men think of him after he has passed hence. No one—even the most hardened cynic—could have been a witness at the unveiling on Friday, or a hearer of the speeches, without learning the truth that it matters much what men think of us after we have gone, and that what they then think of us will depend upon the lives that are closed, and the courses of which are largely of our own shaping. We all know the engineering and administrative genius of Sir George; the gas industry is to-day permeated throughout by their effects. But the dominant thoughts at Friday's function were upon the work that he ungrudgingly rendered to his fellows whose opportunities for, unaided, improving their lot are practically of a negative kind. This work alone entitles him to not only the gratitude of those who have immediately benefited from it, but of the nation at large for pointing the way to greater peace and happiness in a world of industry that, in one or more of its quarters, seems now to be unceasingly in a state of unrest. The panegyric flowed, at the unveiling of the statue, in the homeliest of phrase, quite in keeping with him who was uppermost in the thoughts of those present. His work does not require grandiloquence. In that work, he showed himself to be very human. Being human, he was not without his faults; but the depth and breadth of the rich side of his humanity close out of sight completely what would be left behind in the thoughts of the contemporaries of a man whose life bore the opposite characteristics. Sir George's characteristics were of those transcendent qualities that make us think of him only for the good he did through his self-sacrificing devotion to others.

Such characteristics do not want a monument of bronze or marble; they are to us of the present in themselves a sufficient monument. But no one—worker or visitor—in the future can pass into the main entrance of the Old Kent Road works without seeing what manner of man in outward appearance was this one who wrought so much, who wielded an influence that was urged to its best effects by an indomitable vigour and pluck in that world which seeks to do good to mankind. His work was not a superficial benevolence. It was not something done for the passing glory of the thing. It was not something done to hide, as a veneer, something of a grosser nature. His work was to pull out the roots of an existing evil—an evil fast sapping the goodwill as between man and man—and to establish in its place the roots of a new and promising life. That was where his work was so remarkably distinguished from that of many others. "It is," said Earl Grey on Friday, "his achievement "in the field of moral development which will win for him "enduring fame."

The year 1889, in which co-partnership was founded in the gas industry, was, as his Lordship also remarked, one in which "a spirit of wide unrest seemed to reign throughout "the land; it was a year of general industrial disturbance." The same this year, when those who were the first co-partners in the gas industry have erected their monument to the man who, had he not had the strength of mind and purpose to "stick to his guns" in 1889 and the time immediately following, would have seen co-partnership uprooted in its sapling days. Through him—through his strength that encouraged others—it has lived and has flourished exceedingly. We will not refer to the material advantages that have accrued to the South Metropolitan Gas Company's employees, nor to the employees of those several companies who have since adopted co-partnership. The material advantages are well outlined in Earl Grey's speech. There is something more than these. "Do not "imagine," remarked Lord Robert Cecil on the same occasion, "that co-partnership is merely profit-sharing." It is something more. Look behind the financial side of it, and see. Co-partnership stands on a very firm basis, when the men themselves have position, rights, privileges, thoughts, animating desires that other workers have not got who do not enjoy the same good fortune. Co-partnership in the gas industry is a living triumph to the dead apostle of that vitalizing creation. "As so often happens, the voice of the "Reformer speaks more potently from the grave than "during life." True words these from the lips of Earl Grey; and happy words these: "There is a new light to-day "upon the mountain top." In the midst of current industrial strife, there has been a greater turning from outside of eyes and thoughts to what has been done in the gas industry. The spirit of co-partnership is becoming more widely diffused. It was inevitably bound to be so. "No noble "task was ever an easy one, and nothing good could be "maintained without constant vigilance and earnest work." So in his day spoke Sir George. Though dead in body, his words and his work live.

Circumstances and Carbonizing Method.

To those who claim to know pretty well all the history of carbonization, Professor Vivian B. Lewes's second Cantor Lecture will perhaps be most striking as illustrating in several ways how, even in carbonizing, circumstances alter cases. It was the principal purpose of this particular lecture to show the changes in methods of carbonization that have taken place, and which methods, although based largely on economic considerations, also point to the conditions that influence the yield, composition, and characteristics of various products. So extensively do circumstances alter cases that one has to be constantly on one's guard with qualifying statement, inasmuch as an expression of opinion made in all good faith, and true under one set of conditions, may not be true under other conditions. Exemplifying this, is an assertion of Professor Lewes following the remark that a difficulty common to the process of carbonization in bulk is that the carbonization proceeds rapidly at first, producing a layer of coke next to the heated surface; and this layer, being a bad conductor of heat, retards the process of carbonization owing to the slowness with which the heat is transmitted to the interior of the charge. This is a statement to which no exception is taken. But then we go on to hear that the gas evolved in the interior portion of the charge, having to pass through the heated coke, loses a large proportion of its illuminating power, owing to the dragging down of the hydrocarbons, with liberation of oxygen. The truth of this latter statement depends mainly upon the form and setting of the retort in which carbonization proceeds; for whether in large

or comparatively small bulks, if the retorts are of the vertical form, it is conceivable that the viscous seal between the carbonized portion of the charge and the uncarbonized, or partially uncarbonized, central part will induce the gas in its exit to take the line of least resistance, which will be through the cooler part of the charge.

One striking example of how, in coal carbonization, circumstances alter cases is found in the largely divergent methods of the maker of coke for metallurgical purposes and the maker of gas who gets his coke as a secondary product. We also see how the circumstance that the northern producers of metallurgical coke have "fat" coals with which to deal has retarded among them the adoption of the bye-product recovery types of ovens, which have been so largely, with luxuriant profitable results, applied in other parts of the country. The beehive form of oven is, for the purpose of metallurgical coke production, found best when using the rich coals of the north. Professor Lewes does not blame those who retain this form of oven under such a circumstance, inasmuch as it is metallurgical coke—and of the best quality—that they require from the raw material at their command, although the process is a wasteful one in comparison with the recovery form of oven where the raw material makes these permissible. This was the main point in the argument of Mr. P. C. Holmes Hunt for the adoption at Melbourne of the Dessau system of carbonization—that, with coals which he had at command, he was satisfied that a better coke would be obtained by the intermittent system of carbonization in vertical retorts than from the continuous. There we see, by two illustrations, how the coal available dominates the choice of plant, in order to attain certain ends.

We rather think Professor Lewes still harbours a little feeling that gas makers court high gas makes through high temperatures to the total neglect of their coke; and that this neglect has caused their principal secondary product to only command a market of a limited character. Whatever views may be held on this point, the fact of the large demand for gas-works coke that has been reported from all over the country during last year indicates that the product—high temperatures and large gas makes notwithstanding—is, under the trade conditions that have prevailed, in very good request. From the cheap coke point of view (for purposes where the hard dense metallurgical coke, even when broken small, is not suitable), the product of the gas-works evidently meets a large requirement; and its range of suitability for various applications is certainly being extended by the improved quality of coke produced in vertical gas-retort working and in heavily charged horizontal retorts, and that without any special departure—as in Mr. Thomas Glover's small chambers—from ordinary types of structure. Professor Lewes, in his lecture, mentioned Mr. Glover's small carbonizing chambers as showing marked advances in the products obtained; but now that Mr. Glover is in a position to put heavier charges into his horizontal retorts, we rather think he has no intention of extending the system of small chambers. If our recollection is not at fault in this matter, it indicates that there is not much to choose, in regard to the quality of the coke, between the results of the one and the other system, as now worked. It was for greenhouse purposes principally that a denser sort of coke was needed at Norwich; and this purpose is satisfied by the heavier charged horizontals. This again illustrates how in carbonization practice, circumstances alter cases.

We have known long since—from his evidence in the Parliamentary Committee rooms—the strong views that Professor Lewes holds as to the absurdity of the fidelity of Parliament to illuminating power as the standard quality of gas supply; and he gives expression to them in this second Cantor Lecture. In effect, he says that, if Parliament will only abandon the stupid trammels that bind British gas makers to a standard of illuminating power, which means nothing, and adopt a standard of heating value, which means everything, it will open up fresh opportunities for the gas industry in enhancing its service to the community. There are the substantiating points as to a more open market in which to purchase coal; the adoption of water-gas plant, instead of being compelled to hold extraordinary coal stocks (in view of constantly recurring menace to stoppage of coal deliveries through disturbance in the mining and transport labour worlds); the prospect of purchase in the localities of coke-ovens of the at present waste gas; and generally the supply of a gas of a quality best suited to obtain those high flame temperatures, under both high and low pressure gas supply, that are the requirement of the present day. The primary responsibility of the gas maker in regard to quality of supply is not that which ruled half-a-century and less ago; but still he is tethered to a quality that cannot to-day legitimately claim even the right to a secondary place in his considerations. Incidentally, on the subject of the carbonizing plant of the gas industry, Professor Lewes appears to look very favourably upon the continuous vertical system, which, he says, undoubtedly shows results which will lead to it being one of the most important factors in the future of gas manufacture.

Gas-Engine Problems.

The second lecture by Professor F. W. Burstall, M.A., to the Midland Junior Gas Association, on the "Production of "Power from Gases" was largely of a descriptive nature in relation to engine construction. In almost every mechanical structure, competent critics can find something with which they disagree; and we doubt whether a gas-engine will ever be constructed that will meet in every respect with the approval of individual experts. Structurally, the problems between a gas-engine and a steam-engine are altogether different—the high pressures and temperatures that have to be dealt with by the former rendering the conditions entirely incomparable. Of course, the high temperatures and pressures mean structural weight and bulk; and for this reason, Professor Burstall points out, the use of high horse-power engines—2000 and above—is limited to places, where land has not much value, and where economy is more important than anything else. We do not think that such high-power units are much required excepting in places where land is not very expensive; and therefore, from this point of view, bulk and weight are not characteristics of imposing importance there. There is the question of capital cost, too. To get large gas-engines down to a safe lighter construction would probably be a more costly thing than the present provision of weight and size. It is also very questionable whether, in the smaller sizes, any expenditure of capital on a reduction of weight and dimensions would be compensated for by any commensurate advantage; and there is further an existing doubt as to whether any additional capital expenditure would be compensated for by anything that could be placed to the credit of efficiency. On the whole, there does not appear to be any ground for thinking that there is yet in sight a more economical basis of gas-engine construction that will, at the same time, yield any greater material benefit to the user than is obtained now. The best work, structurally, that can be done is to try to effect an enhanced reliability by the removal of those defects that experience has disclosed. They are not greater, but somewhat less, than exist with the electric motor; but the character of the defects that produce failure suggests that certain of them might be avoided by closer attention to structural details.

A Large-Hearted Electricity Bill.

It has for the past few years been one of the earnest desires of the Incorporated Municipal Electrical Association to promote a Bill universally conferring on municipal authorities owning electricity supply undertakings electric wiring and fittings powers of a very comprehensive order. But they have been faced by two obstacles—the one the strong opposition of the Electrical Contractors' Association, and the other that they oould not obtain the extensive support, financial and otherwise, that they had hoped to do from those whom they, in their belief in wiring and fittings powers, consider they are benefiting by their action. But now they are tired of negotiating. They find it impossible to get all the municipalities and the contractors into one camp for prosecuting in Parliament this extension of electricity legislation and municipal trading; and so they have now lodged a Bill to obtain several powers on behalf of all electricity undertakings municipally governed. Why the Bill has been introduced at this particular period in a waning parliamentary session is not very clear, unless it be for the purpose of showing local authorities that this time the Association mean business, and that the extraordinary powers with which it is sought to cloak the authorities through the Bill are worthy their indulgence in a substantial monetary way. There is a large amount of admiration, mingled with amusement, at the boldness of the scheme of this Bill in various respects—both as to the wiring and fittings powers, and as to certain financial proposals.

Upon these matters we have inflicted a few comments

in our "Electric Supply Memoranda." There it is shown that precedent and model clauses are set at naught in the Bill, and that the Municipal Electrical Association are going to run full tilt against what are obviously regarded as the absurd financial restrictions imposed by Parliament and the Local Government Board on municipal electrical trading enterprise. It is very inconvenient to some local authorities to have their electrical finances critically scrutinized by the Local Government Board; and so in certain respects the Association are proposing that plenary powers shall be entrusted to the authorities in connection with working capital. If the promoters succeed with these proposals (not that we think they will), we shall be among the first to congratulate them. But there are grave doubts, apart from the severe opposition the Bill will encounter, of Parliament consenting to give the extensive liberty which the Bill desires. We cannot imagine our Legislature tolerating and sanctioning the transfer of so much power, with so little safeguard, into the hands of municipal authorities generally who own electricity supply undertakings. Nor can we picture Parliament condescending to allow a privately promoted measure of this sort amending the general law referring to municipal electricity undertakings. At all events the authorities who do not support the measure financially should be left outside it. But we think it more than probable that, if Parliament does not reject the Bill in its entirety, it will so alter its facial appearance that it will hardly be recognized as the measure that, with all its *bizarre* boldness, now lies before us. It will be recognized that the measure is one against which, in its present form, gas companies have a right to protest from the point of view of an unwarranted liberty, and altogether inadequate safeguards against reckless proceedings.

Purification and Carbonization.

Besides students, those among gas engineers who desire to refresh their memories as to the technical work that has been done in connection with the purification of gas will find a good abbreviated survey of its history in the paper that Mr. Harold E. Stone read before the Midland Junior Gas Engineering Association last Saturday. It is rather an ambitious thing to attempt to compress such a vast history into so small a space, and a history, too, that is strewn with probably more failures than successes, until now the present practice is essentially that, with improvement, which has done duty through the greater part of the period of gas supply. We rather regret (seeing that students can obtain the information elsewhere) that so much time was spent by the author over the early history of processes, and that so little notice was taken of the coal-liming process, and no notice at all was bestowed upon the revival of the process, under new conditions, of the conversion, or rather the partial conversion, of carbon disulphide to sulphuretted hydrogen by subjecting the former to heat. In connection with this latter process, the high temperature difficulties, it is hoped, will be overcome through a system developed by one of the technical workers of the South Metropolitan Gas Company, whereby he preheats the gas before subjecting it to the heated contact substance. However, perhaps Mr. Stone preferred not to tread in regions that are now undergoing exploration, and with which, in all likelihood, he has no personal experience.

There is not much to discuss in the paper. But one point especially interests us, and may be dilated upon—that is, the effect of modern systems of carbonization upon purification. This would have been a very serviceable, and a modern, side of the question for discussion. The new systems of carbonization ought to do much to lighten the embarrassing circumstances of gas purification, and ought at the same time to extend the field for improvement in practices. We know how largely the vertical retort method of carbonization has reduced the grains of sulphur compounds in gas. With this reduction, the problems of purification are much simplified; and the carbon disulphide being lessened to limits recognized by professional gas men as not prohibitive, there is no need for any auxiliary plant or process for dealing with the impurity. Mr. Stone, in a sentence, reminds us that we can go farther in this matter. He remarks that "cyanogen ought to be absorbed tho- "roughly in some portion of the plant, as, with the high "temperatures of carbonization now employed, the amount "produced is much greater than used to be the case." He is very much impressed with this formation of cyanogen at high temperatures, as again there appears the observation: "The amount of this substance formed at the temperatures "now in vogue is considerable." It is well known that an excessive amount of cyanogen in the gas shortens the life of oxide; while the manner in which it pays unwelcome attention to service-pipes, meters, and other property outside the works is not a commendable attribute. Its presence, too, in gas is an obstacle to the use of ammonia as an aid to purification by oxide of iron. But though high temperature carbonization in horizontals and inclined retorts has meant the greater intrusion of cyanogen in the gas, we find, from long experience, that high temperatures can be used with the vertical retort systems, and a comparatively low cyanogen content occur. It was seen in the Cologne records quite recently that, in the crude gas from the vertical retorts, the grains of cyanogen per 100 cubic feet only amounted to 46·3, while in the purified gas the number was down to 8·74 grains. The respective figures for gas from inclined settings were 101·4 and 19·67 grains. Therefore, as far as high-temperature vertical retort working is concerned, Mr. Stone's suggestion as to the thorough absorption of the cyanogen in some portion of the plant may well be qualified.

Regarding the reference in the paper to the Feld process being tried at East Hull, nothing has been heard of the installation for some time now; and we rather fear that the original plant did not meet there with the entire success that was anticipated. However, Mr. Stone looks hopefully to there being developed a practicable liquid process of purification in closed vessels; as, though the cost of oxide purification is so low, he thinks its disadvantages would cause it to be superseded if a suitable method came along. In other words, it would be worth something extra in the way of cost to be rid of the disadvantages. But the superseding process is not among us yet, despite the spending of thousands of pounds and the ardent endeavours of highly talented men.

Some Rating Statistics.

Through the courtesy of Mr. James Carter, the Borough Treasurer of Preston, we are able to-day to give some information in our news columns from the twenty-seventh annual statement compiled by him, giving particulars of the rates levied for 1911-12 in various towns, the charges for gas, water, and electricity, and the profits and losses on municipal undertakings by which the rates have been reduced or increased. Though, of course, the list of towns included is not intended to be anything like exhaustive, it may perhaps be regarded as fairly representative, inasmuch as towns of all sorts and sizes are dealt with. The number of places included, too, has grown steadily, until now information is given with regard to ninety-five towns and metropolitan boroughs, which is one more than last year. A glance down the list shows that the cases in which the rates levied for 1911-12 are less than those raised the previous year are but slightly fewer in number than those in which the amount is more. Dealing with the latest return, there are thirteen places where the amount in the pound levied for rates is shown to be 9s. or over. This number compares with twelve a year ago, and thirteen the year before that. Norwich again heads the list with 10s. 8d. in the pound; and, also as usual, East Ham and West Ham come second and third, with 10s. 1d. and 9s. 11d. respectively. This is an increase of 5d. for the year in the case of Norwich, 3d. for East Ham, and 2d. for West Ham. The number of instances in which the rates amount to 8s. or more in the pound is 37 on the present occasion, as against 33 and 36 for the two immediately preceding years. The only places included in the list in which the rates are 5s. or less in the pound are Blackpool and Bournemouth (5s.) and Oxford (4s. 8d.). Blackpool benefited to the extent of 8d. in the pound from "reproductive" undertakings, and Oxford 7¾d. But Bournemouth suffered losses by which the rates were increased 1d. In 21 of the places dealt with by Mr. Carter the price of gas is 2s. or under per 1000 cubic feet for domestic lighting purposes, compared with 17 last year—the additions being Burnley, Gloucester, Lincoln, and Wallasey (the last-named town appearing in the statistics for the first time this year). Widnes is still first in the matter of cheapness. For a domestic supply of electricity two places in the list charge 6d. or more per B.T.U.; while in Bury, on the other hand, the charge is 2¾d. Fourteen of the towns (as against ten last year) relieve the rates to the extent of 1s. or more in the pound in consequence of the carrying on of profitable

undertakings; but there is also a list (in which 43 out of the 95 towns find a place) showing the amount in the pound by which the rates have been increased as a result of deficiencies on municipal enterprises. In six cases the levy reached 1s. or more in the pound.

The Next Smoke Abatement Exhibition.

In noticing last week the projected Smoke Abatement Exhibition for London next year, it was stated that "the Institution of Gas Engineers and the Society of British Gas Industries are not officially having anything to do with the display." Then we went on to suggest that it would be a pity for the gas industry not to be represented at the exhibition—if not by individual firms, by a combined effort, which could be made a striking one by the firms manufacturing gas-heating appliances. It is true the Society of British Gas Industries are not officially taking part in the exhibition; but it appears that it was a mistake to say the Institution were not doing so. The blame for this mistake must rest on other shoulders than ours. It had got abroad that the Institution were not officially recognizing the exhibition; and the mistake would never have obtained currency had some notification been made to us for publication as to what the Council were doing in the matter. This is an occasion on which privacy has not assisted gas publicity, nor to the end desired.

Representation of Gas Interests.

We are not sorry that the erroneous statement was made last week, as it has brought to knowledge the fact that this Smoke Abatement Exhibition is a case in which the Council of the Institution consider that the gas industry ought to be represented. Accordingly, the President (Mr. R. G. Shadbolt) was nominated by the Council to represent the Institution on the Exhibition Advisory Committee; and, in addition, Mr. Shadbolt has been appointed Chairman of the Domestic Gas Sub-Section. As Vice-Presidents or on the Committee, the President is supported by such representative men as Mr. Corbet Woodall, Mr. Charles Carpenter, Mr. Charles Hunt, Mr. D. Milne Watson, Mr. F. W. Goodenough, Mr. F. M'Leod, Mr. James W. Helps, Mr. A. E. Broadberry, Mr. S. Y. Shoubridge, Mr. Hanbury Thomas, Mr. Cyril G. Davis, Mr. T. Glover, and others.

If not Individual Effort, Why not a Combined Display?

The mention of these names should have a prevailing influence upon those who, after all, are in the main able to make or mar proper representation at an exhibition of this kind. The abstention of gas from this Smoke Abatement Exhibition would admirably suit the views of the rivals of the gas industry for heating and cooking; and no one would wish public judgment to go against the gas industry through any default. If the gas-stove firms do not wish, in view of their support of exhibitions during recent years, and the one in prospect for 1913, to go to any large individual expenditure of time and money over the Smoke Abatement Exhibition, there is the suggestion thrown out last week as to a good combined exhibit—something that would be striking—under the supervision of an independent manager after the manner of the general display, during recent years, at the White City. We hope sincerely that this idea will be taken into consideration. In this connection, it may be mentioned, as pointed out in our "Correspondence" columns to-day, that the date of the exhibition has been altered from May to March 23; and it will continue to April 4.

The Gas-Electric Contract for Holborn

It is a pity that councillors before they address public bodies such as the London County Council do not ensure the correctness of their "facts." The combined contract that the Holborn Borough Council have accepted from the Gaslight and Coke Company and the Metropolitan Electric Supply Company has been before the Finance Committee of the London County Council, on a *pro formâ* application by the borough authority for sanction to a loan of £8000 for the capital expenditure required in carrying out the contract. As a matter of fact, no actual loan is needed by the Council, inasmuch as the price quoted by the Companies is one that includes capital expenditure; and so eventually the street-lighting equipment will become the fully paid-for property of the Council without parting with a penny piece outside the annual contract payment. The Finance Committee of the London County Council evidently consider the Borough Council have made a good bargain, and recommended that the Council should ratify the proposed capital expenditure. But when the matter was before the Council, Mr. J. D. Gilbert opposed. He seemed, as a matter of fact, very annoyed that the Gas Company and the Electricity Company and the Borough Council should have had the temerity to enter into a compact the like of which has never been heard of before. Mr. Gilbert would manifestly prefer, in this connection if not in other affairs, to keep in the old contractual ruts, and never to have any departure from them. This is not how progress is made. He thought it quite unusual for Gas Companies and Electricity Companies to join hands in the manner that has been done here. No doubt it is; but it was a prudent step under the circumstances. He would also have expected the Finance Committee to have been very severe upon the Borough Council for entering into an agreement for ten years for the purpose of street lighting. The Borough Council would never have got the terms they have done for a less period. The statements this gentleman made as to the charges for gas north and south of the Thames were also not in accordance with facts. However, the most caustic criticism of Mr. Gilbert's views is the speech which embodies them. The recommendation of the Finance Committee did not suffer through the opposition.

And for the City.

The "Electrician" deals very fairly with the City lighting contract, and has done the correct thing in pointing out that the Gaslight and Coke Company have taken on their shoulders the lighting of 45½ miles of streets at a less price than the Electric Supply Company are to be paid for 10½ miles; and that consequently the small gas units that will perforce have to be used in 44 miles of the 45½ miles, totally disestablishes any comparison between them and the large flame arc units as to economy on the illumination basis. The whole scheme has practically been one of arrangement between the parties concerned; the fact that in greater part the main streets are already (under the old contract) in the hands of the Electric Supply Company having been a matter for consideration in the settlement. The "Electrical Times" states that, in one way, the contract is a triumph for electricity; for "excepting Fleet Street, all the leading thoroughfares are to be lighted by electric arcs." Is this carelessness, or wilful misrepresentation? Last week we reported that of the 45½ miles to be gas lighted, high-pressure centrally suspended gas-lamps would be installed in the following streets: Arthur Street East, Cannon Street (eastern end and central), Fish Street Hill, Fleet Street, Golden Lane, Lower Thames Street (part), Monument Street, and Queen Street (from Queen Victoria Street to Cheapside). In addition, there will be high-pressure gas lighting on columns in the following main thoroughfares: Queen Victoria Street, 43 2000-candle power lamps; New Bridge Street, 2000-candle power lamps; Mansion House Street, 3000-candle power lamps; Lombard Street (part), 2000-candle power lamps; and on the lavatories in front of the Royal Exchange and Gracechurch Street. Why does the "Electrical Times" circulate misleading statements in regard to London public lighting contracts? It is not playing the game.

The Output of Coal.

A small increase in output and a larger proportionate increase in value briefly sums up the situation as regards the coal statistics for the year 1910, as given in Part III. of the Annual Report on Mines and Quarries, which was issued at the end of last week. The principal points of the report will be noticed (at greater length than is possible now) in the next issue of the "JOURNAL;" but meanwhile a few figures which indicate the progress of this very important industry—not only in 1910, but over a series of years—may be noted. Following the yearly increase in output of coal in the United Kingdom between 1901 and 1907—during which period the quantity rose from 219-million tons to nearly 268 million tons—there was a slight falling off in 1908; but in 1909 some recovery took place, and in 1910 this was continued. As a matter of fact, in 1910 the output was nearly 264½ million tons, which was an increase of 660,000 tons over that of the preceding twelve months. This small gain in quantity in the year under review was, as already remarked, not at all in proportion to the extra value of the coal—this being £108,377,567 in

1910, or £2,102,667 more than in 1909. The average value per ton of coal at the pit's mouth for the whole of the United Kingdom is given as 8s. 2·37d., as compared with 8s. 0·7d. for the previous year. The quantity exported, exclusive of coke and manufactured fuel, and of coal shipped for the use of steamers engaged in foreign trade, was over 62 million tons, or nearly a million tons less than that for 1909. Adding the 3 million tons exported in the shape of coke and manufactured fuel, and the 19½ million tons shipped for use by British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country during 1910 was 84½ million tons. Thus the amount of coal remaining for home consumption was close upon 180 million tons, or 4·005 tons per head of the population. The Blue-Book sets forth that during the past thirty-eight years (1873 to 1910) the total value of the minerals raised in the United Kingdom amounted to £3,103,204,269; and of this sum, coal accounts for £2,576,353,911, or 83 per cent. Of the output of 7,120,840,000 tons of coal which is represented by this huge value, more than 23 per cent. has been shipped abroad as exports in the form of coal, coke, and manufactured fuel, and as coal for steamers engaged in foreign trade.

BRITISH COMMERCIAL GAS ASSOCIATION.

Referring to the work of the new British Commercial Gas Association (which all having the interests of the gas industry at heart are anxious to see started as quickly as possible), it should be pointed out that a number of undertakings have not yet sent in their list of nominated members, as requested in the letter of the 3rd ult. This is probably unavoidable, but is none the less regretable, as the election of the General Committee cannot be proceeded with until the names are sent in.

It is hoped that all arrangements may be quite completed for electing the Committee early in the New Year, and the scheme got into full operation. It may be added that fresh promises of support continue to be received from undertakings the boards and committees of which have recently had the matter under consideration; and there is every indication that the Association will prove of material benefit to the industry. The movement should, therefore, receive a full measure of support from all parts of the kingdom.

AN INDUSTRIAL GAS INSTITUTE FOR JAPAN.

Ever moving with the times, the gas engineers and managers of Japan have organized themselves under the designation of the Industrial Gas Institute of Japan (Kogyo Gas Kyokwai); and, the gas industry the world over will be wishing this youngest of Gas Associations a highly successful career, though it cannot be expected that the membership will be large. The objects of the new organization and the classes of membership are of the simple kind that will give a broad field of operations. The purposes are to induce an extension of cordial and friendly relations between members, to promote scientific and practical knowledge in all matters relating to the industry, and to secure the more rapid promotion and advancement of the interests of the industry. The objects are correct, and worthy the encouragement of all associated in any way with the gas undertakings of Japan.

The Institute are not going to circumscribe their basis by any narrow view as to eligibility for membership; but there are going to be very distinct classes. There are to be (this is the order in which our Japanese friends place them) four classes: Honorary members, associate members, active members, and junior members. The class of associate members placed in order before the active members is interesting; and, as will be remarked, this class will afford practically all well-wishers the means of directly identifying themselves with the work of the Institute. First, as to honorary members. Those qualified for the position are to be persons whose scientific attainments or practical knowledge in matters relating to the gas industry recommend them to the members of the Institute. Associate members will be persons who are desirous of affording assistance and support to the objects the Institute intends to promote. Active members are to be engineers who have scientific and practical knowledge of all matters concerning the gas industry, or have close relations with it. Junior members will also be persons whose occupation has relation, or close connection, with the industry. The members are always to wear the badge of membership.

A designing department is to be established in connection with the Institute. To this department the members will be able to submit designs and proposals as to superintendence in matters affecting new construction and extensions and repairs, as well as drawings and specifications, and questions as to the recommendation and the remuneration of engineers (presumably in connection with the construction, extension, and repairing work). The department will also make recommendations as to machinery, appliances, fixtures, &c. Through the same channel will flow questions and answers on all matters affecting the gas industry.

Of the gas companies in Japan, there are at present thirty whose works and businesses are in the hands of members of the Institute; and these companies at present represent a capital of 25,000,000·00 yen. The first Chairman of the Institute is Mr. Sakura Okamoto, Director of the Nagoya Gas Company, and Director and Engineer to other undertakings. There are five members of the Committee; and the member from whom this interesting information has been received is Mr. Y. Uchiyama, Chief Engineer of the Nagoya Gas Company.

CONSOLIDATED GAS COMPANY'S NEW OFFICES.

A Fine New York Building.

Below will be found a view of the first section of the new twelve-storey building recently completed for the Consolidated Gas Company of New York. It represents the left half of the whole structure, as shown in the architect's drawing; but it is considered probable that the plans for the second section may be altered somewhat, to allow of the addition of two storeys. The entire building, when completed, will stand on a plot 84 feet long on one side and 155 feet long on the other.

It has been designed by Mr. Henry J. Hardenbergh; and it is regarded as the most artistic edifice in the thoroughfare on which its shorter side abuts. The new section is on one side contiguous to the old building in which the present organization originated. This building was the office of the Manhattan Gas Company, who went there about 1852 (the date of its erection), having previously had offices elsewhere; and when the consolidation of the New York Gas Companies took place in 1884, the Company and also the New York Company (started in 1823) joined the combination. For nearly sixty years, therefore, the site on which the new building stands has been occupied by the offices of the Gas Companies of the city.

Our illustration and the particulars above are from the last number to hand of "Progressive Age."

French Technical Committee on Artificial Lighting.—As readers may remember, the proposal to levy a tax on gas and electricity has been abandoned by the French Government, and other means are to be adopted of helping to balance the Budget. A Technical Committee has been appointed by the Minister of the Interior to study the comparative value and effects of the different systems of artificial lighting—vegetable oil, paraffin, coal gas (with ordinary and incandescent burners), electricity, &c.—and to draw up a report. The President of the Committee is Dr. Gariel, of the Faculty of Medicine, and it includes several eminent oculists, as well as representatives of the Gas and Electric Light Companies. The best methods of measuring candle power, the gases and heat given off by some modes of lighting, the minimum light necessary to assure the normal use of the organs of vision, the cause and prevention of short-sightedness and blindness, are among the subjects to be studied. According to the "Ironmonger" (from which the foregoing particulars were obtained), the general impression appears to be that there are too many scientists and not enough practical men on the Committee.

THE DAILY PRESS AND THE GAS INDUSTRY.

"Engineering Correspondent" of the "Daily Telegraph" on Gas-Furnaces and the Engineering Status of Gas Officials.

APPRECIATION is shown by the "Engineering Correspondent" of the "Daily Telegraph," in an article published yesterday on "Gas-Furnaces," of the fact that there is something good to be said of the gas industry; and yet there are many evidences in the article that he does not yet know the gas industry, the technical and commercial qualifications of its professional men, nor much of its methods. Probably knowledge of these matters will come in time. We particularly wish to refer to certain of them.

In the first place in the present article, he mentions that the authorities at the Royal Mint have adopted town gas for furnace purposes, after experimenting with gas, oil, and coke. He omits notice of the fact that the experiments also extended to electricity; and this, from the point of view of the gas industry, is not an altogether unimportant fact. Some figures are also given as to the employment of gas in other industries for furnace and crucible heating; and, in association with this matter, we accept his statement freely that he has "for years advocated the extension of what may be called the metallurgical and industrial load for the large gas-works of the country." In our "Miscellaneous News" columns, we have reproduced some of the figures he has now published. He refers to the economy and cleanliness of the gaseous mode of heating. The directions of economy are pointed out fairly. But there is one that is not mentioned, which has been found of great importance in the Birmingham area; and this is the value of the gaseous method of heating furnaces and crucibles, and for annealing work, in speeding-up factories and increasing the output on the time or man basis.

Then we arrive at the general principle which he wishes to enunciate. "It is that in the cities and towns every inducement should be given to manufacturers to use such a satisfactory heat source;" but he goes on to say that he has a suspicion that "the gas authorities have not cultivated that sort of load sufficiently in the past." We are quite in accord with the suggestion as to inducements being offered to the manufacturers; and the gas industry has its eyes set on, and its endeavours actively addressed to, this purpose. The reason that more has not been done in this direction in the past is due more to stupid legislative fetters than to want of enterprise on the part of the gas industry. We have been tied (and it has been an uphill fight with Parliament to get even the release that has so far been obtained) to a standard of illuminating quality of gas that science and applied science in the gas industry have rendered totally unnecessary, and that standard has necessitated the wasteful spending of money in the production of gas. In a large number of gas undertakings, too, in the country, there have been the statutory limits of 10 and 15 per cent. discounts from lighting prices in consideration of respectively prompt payment and large consumptions; and only in the case of concerns so trammelled who have recently been to Parliament has freedom from these discount restrictions been obtained. Even the partial loosening of the illuminating power bonds has shown what the gas industry can effect in supplying an increased number of B.Th.U. for a given price; and as the parliamentary concessions extend, so will the opportunities of the gas industry. Taking these matters into consideration, "Engineering Correspondent" must agree that the "onlooker" who, he claims, sometimes sees "most of the game" may be deceived, and that seriously, by superficial appearances.

We proceed to learn the view of "Engineering Correspondent" that "in the past the gas engineer has lived outside the circle of engineering. Chemistry forms such an important part of his training that there seems to be a tendency to imagine that engineering is unnecessary." We rub our eyes to see that we have not misread our critic's words; but there they are—we are sorry to have to say, senseless and untrue—in black and white. In this connection, we again see how the "onlooker" may be gravely deceived. The knowledge of this "onlooker" of the gas engineer and his work is lamentably deficient. We should like to drop him into a few of the gas-works of this country; and let him see how, from the incoming coal to the distribution of the gas, both constructional and mechanical engineering play an immense part, and in a variety of substantial ways of which the average electrical engineer has very little knowledge. There are in this country 794 statutory gas undertakings (to say nothing of the non-statutory ones), with an issued capital of £132,123,284. We really wonder what infinitesimal part our critic thinks engineering has had in the spending and safeguarding of this capital. We will not labour the point in our columns. It would be ridiculous to do so. But, in connection with it, he further says:

> It may be noted as a curious fact that the Institution of Gas Engineers contains about 700 names, whereas the list of the Institution of Electrical Engineers runs into over 6000. We think it would enormously increase the importance and authority of the gas engineers if they had many more members for their Institution. One of the things which need immediate reform is the inadequate (average) salary of the gas engineer and manager. Little reward is offered to the enterprising and industrious.

There is no occasion to grumble over any effort to increase the professional gas man's remuneration. Anything in that direction will be welcome; and "Engineering Correspondent" may hammer away at it to his heart's content, without fear of censure. But the comparison with the Institution of Electrical Engineers must not go unchallenged. It is not a fair one. There is nothing in common between the two Institutions in regard to the constitution of their membership. In the first place, the Institution of Electrical Engineers draws its members from not only the electric supply industry, but from that dealing with electrical tramways and railways, telegraphs, and telephones. Practically anyone who calls and professes himself to be an electrician has in that Institution a class to which he can find entrance. The "Engineering Correspondent" of the "Daily Telegraph" is allowed to be an associate member. For the Institution of Gas Engineers, we have only the gas-supply industry from which to draw members. Now let us analyze the membership of the Institution of Electrical Engineers to see how the 6000 odd members to which "Engineering Correspondent" refers is made up. The last returns at hand show that 1174 were members, 2623 associate members, 941 associates, 1363 students, 103 foreign members. The total membership of the Institution of Gas Engineers is 843; and of those 706 are of the member class—the remainder falling in other classes. The 706 are gas engineers and managers (all but a few) in active official service, or practising now as consulting gas engineers. Now if our friend will tell us how many of the 1174 members of the Institution of Electrical Engineers are purely city or town central station engineers and managers, we shall then get the comparison on a fairly common basis. But it is absurd to make any other comparison; for, taking the Institution of Electrical Engineers as a complete body, there is no similarity between it and the Institution of Gas Engineers in the matter of composition. The last issued census of production returns gives us a comparison that is rather interesting on the point of responsibility. We quote from a previous article of our own on the returns:

> Under the head of gross output, selling value, or value of work done, the gas industry claims £31,607,000; the electricity supply industry, £8,903,000. The value of the materials used in the gas industry is given at £14,329,000; and in the electricity industry, at £3,335,000. The net output is therefore, for the gas industry, £17,278,000; and for the electricity industry, £5,568,000. The labour employed in the gas industry totals to 83,531—that is, so far as the returns allow calculation to be made. But it is admitted that there has been omission in several returns of members of the outdoor staff—the collectors, inspectors, and so on. The electricity industry only employs 22,618 persons. It is not clear whether the statistics as to electricity stations include or otherwise those parts that are utilized for tramway service.

We think this shows something as to the efficiency of the engineers and managers of the gas industry.

In justice, we must quote the following from "Engineering Correspondent's" article, as it bears on the controversy with him:

> There seems to have grown up an impression that these columns show an undue bias in the direction of electricity. If reference has been omitted to the more recent advances made with the inverted incandescent mantle and high-pressure gas, it has been because we have not had available information which we consider puts the case fairly. During the last few days a mass of correspondence on the subject has come to the writer's notice; and he is doing his utmost to digest it. It is only fair to say that some of it shows quite clearly that there are many people who are thoroughly satisfied with the high-pressure gas lighting. At the same time, we believe the load of the future for gas is for heating purposes. Compared with that, the lighting load in the large cities does not seem important.

It is clear from this that "Engineering Correspondent" does not appear at present over-sanguine as to the position of gas lighting; and his belief rather inclines to the heating business being the future portion of the gas industry. The gas industry intends to capture a very large part of the heating business of the country; but it is not prepared to abandon any other part of its trading. There is no reason why it should. Let "Engineering Correspondent" consider these facts. During the last score years the gas output of the industry has *doubled*. [See Board of Trade returns.] From figures obtained from various parts of the country, we find that many gas-works are now sending out 40 to 50 per cent. of their annual output during the daylight hours; so that the consumption during the hours of darkness at the present time is practically equal to, or rather more than, the total output of twenty years ago. And this despite the incoming of first the economizing upright incandescent gas-burner, and then the more economical inverted one, together with the competition of electricity for lighting. That is a solid fact that cannot be dislodged by personal opinion or electrical desire or prophecy, of which we get an absurdly large quantity. We think that this article will give "Engineering Correspondent" a little better indication than he at present evidently possesses as to the standing of the gas industry and of its men.

Professor Lewes on the Carbonization of Coal.—At the Society of Arts last night, Professor Vivian B. Lewes delivered the third of his Cantor Lectures. Having in the two preceding lectures dealt with the composition of coal and the changes which have been effected in the retorts used for its carbonization, the lecturer directed the attention of his audience to the thermal conditions existing during the process. Among the points considered were the losses of heat in a retort-setting; the transmission of heat through the retort and the charge; the temperatures existing in retorts and ovens; small and full charges; and influences leading to improvement in products from full charges and chamber and vertical retorts. A report of the lecture will appear next week.

A LIVESEY MEMORIAL STATUE

Unveiled at the Old Kent Road Gas-Works.

At the invitation of the Chairman and Directors of the South Metropolitan Gas Company, a large gathering took place last Friday afternoon at the Old Kent Road works, to witness the unveiling of a memorial statue of the late Sir George Livesey, which has been erected by the shareholders, officers, and workmen of the Company.

The ceremony was performed by the Right Honourable Earl Grey, G.C.B., G.C.M.G., G.C.V.O.; and the speeches (of which a full report is subjoined) were throughout of a character worthy of the occasion—being full of earnest belief in the principle of co-partnership, and of heartfelt tributes to the memory of the great departed leader. Earl Grey was accompanied on the platform in front of the statue by the following gentlemen: Mr. Charles Carpenter (the Chairman of the Company), Mr. Frank Bush (the Deputy-Chairman), Mr. J. Ewart, Mr. K. Hawksley, Mr. Frank H. Jones, Mr. L. W. S. Rostron, Mr. J. D. C. Hunter, Mr. W. Cupit, Mr. J. Newbold (Directors), Lord Robert Cecil, Mr. Corbet Woodall, Mr. W. G. Bradshaw, Mr. Henry Vivian, Mr. F. W. Pomeroy, Mr. W. Doig Gibb (Chief Engineer), and Mr. F. M'Leod (Secretary). Among those present was Mr. Frank Livesey, a nephew of Sir George.

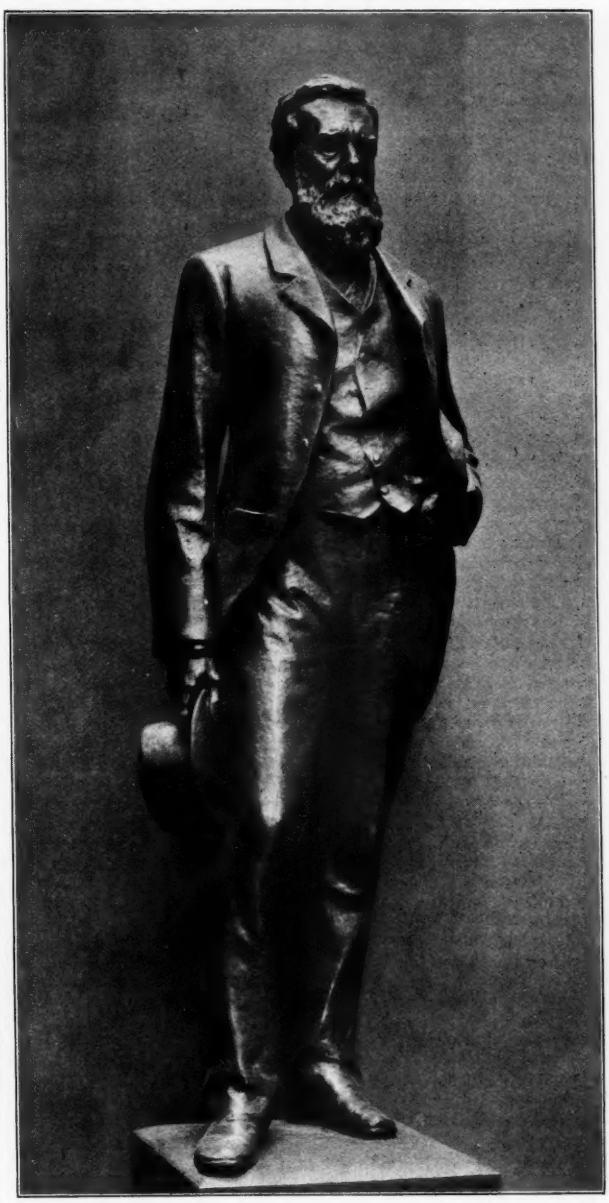
There was a guard of honour provided by the Sixth City of London Rifles (Metrogas Company), under Captain E. Stokes; and a selection of music was rendered by the band of the same company, the Conductor of which was Mr. Sydney Herbert. There was also in attendance the St. John Ambulance Brigade (Metrogas Division), of which the Hon. Surgeon is Mr. A. A. Ward, M.D., and the Superintendent Mr. W. G. Butcher.

The statue (a description of which appeared in the "Journal" for May 3, 1910, p. 297) is on an excellent site close by the entrance to the offices of the Company. On the front of the pedestal there are the words "George Livesey, 1834-1908;" and on the back appears the following inscription—

> Sir George Thomas Livesey, M.I.C.E.
> Entered the South Metropolitan Gas Company 1848; became Engineer 1862, Director 1882, and in 1885 Chairman—a position he occupied until his death. He enriched the gas industry by many inventions, was a strenuous advocate of the sliding-scale, and in 1889 founded the co-partnership of the Company. This monument was erected to his memory by the shareholders, officers, and workmen, 1909.
> B., April 8, 1834; D., Oct. 4, 1908.

When Earl Grey, who received an exceedingly cordial welcome, had taken his seat on the platform, he was introduced to the assembly by the Chairman, in the following words.

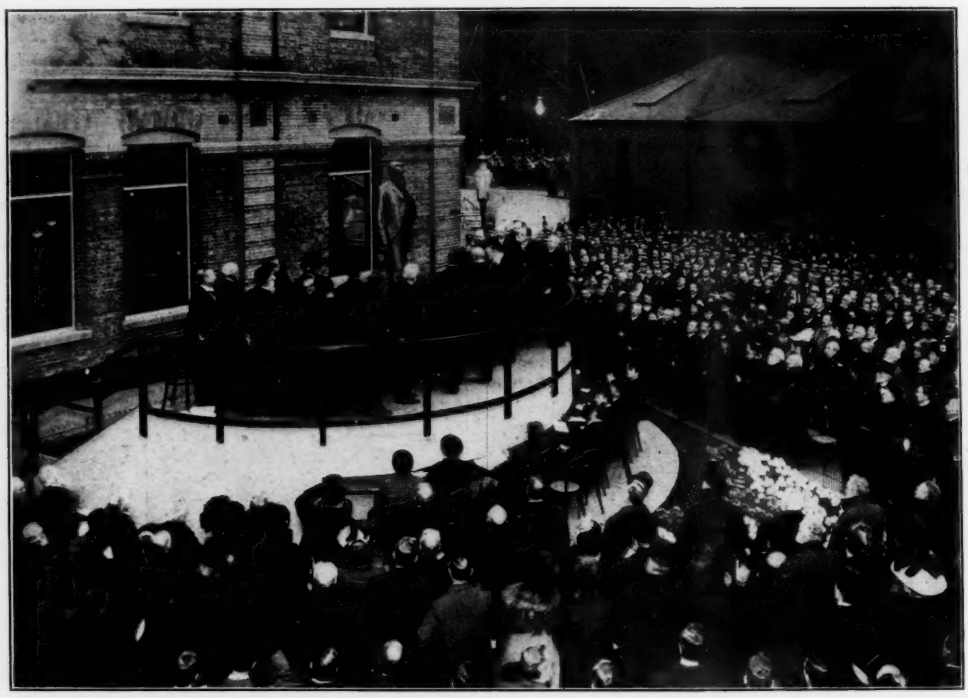
Mr. Carpenter: My Lords, Ladies, and Gentlemen, Co-Partners past and present,—I am sure that I need say very little indeed by way of an introduction, either with regard to the object of this ceremony this afternoon or with regard to the performer of it. Yet, if you will bear with me for a few moments, I will explain as briefly as possible the circumstances associated with the gathering here this afternoon. The late Sir George Livesey was an earnest and generous supporter of religion. He was a great advocate of education in the broadest possible sense of the word; and the Livesey Free Library, which is just outside the gates, bears continual testimony to this fact. At the same time, but few men realized so well as he did the importance of recreation, in providing a sound body to stimulate the working of a healthy mind; and I need not remind you that one of the important gifts to this neighbourhood was the Telegraph Hill, to which he was, in fact, the principal contributor. But these reasons, admirable as they may be; these qualities, estimable as we know they are, would not have been, of themselves, a sufficient opportunity for this gathering. The debt we owe to Sir George Livesey is in respect of his advocacy—his successful and magnificent advocacy—of co-partnership. I do not want to anticipate the remarks which his Lordship will make upon the subject; but I should like to say that I have been a participator in co-partnership, I have been one of its administrators, and I am now its President; and I can say that, during the last twenty-two years, under the *régime* of co-partnership, our men have been bound to us—we have their sympathy, their goodwill, and their help in all our undertakings—in a way which would have been utterly impossible, and is utterly impossible, under any other system whatever. I do not know how long the idea of co-partnership was fructifying in Sir George Livesey's brain; but records of our Company show that, in the year 1872, he made a proposal that the workmen then employed by the Company should be given a share in its prosperity over and above the usual wages they were in the habit of receiving. That is as far back as 1872. He never lost sight of the idea; and in 1889 he realized that his hour had come, and he proposed (and carried) the great scheme of co-partnership which you understand so well, and in which you are all of you participators. These are the remarks that I desired to make in introducing you to his Lordship to-day; and I think they sufficiently explain the reasons why this gathering has taken place. The shareholders and the co-partner workers subscribed for the purchase of the statue which will soon be unveiled. Now, it may be asked, Why is it that you want what we may call an artificial reminder of the great and good work which Sir George Livesey carried out? Well, I will give you the reason as it appeared to the co-partners. Sir George's influence was largely a personal one; and it is to his great personality that we owe most of the success which attended co-partnership in its commencement. The object of the co-partners who were responsible for the idea of the statue was to keep alive as far as possible the features, the unassuming pose, the fine brow, and the kindly, but keen, intelligent eyes of the man as we knew him. We hope that by this means we shall not only refresh the memories of those who did know him, but that we may inspire fresh memories



THE LIVESEY STATUE.

[As the statue itself is, of necessity, small in the photographs on pp. 746 and 747, showing the unveiling ceremony, we reproduce above the illustration as it appeared in the "Journal" for May 3, 1910, p. 297.]

in those who, year after year, join our co-partnership as the older hands become pensioned. Well, then, we provided the statue; and for twelve months it has been covered up (as most of you know) in its canvas and packing. The reason of this was that we felt the object was worthy of the greatest honour we could bestow upon it; and we thought the one man among His Majesty's subjects best qualified and best fitted to perform the task of unveiling was the Right Hon. Earl Grey. Earl Grey not only knew Sir George Livesey well—knew the man and his ideals; but he himself is one of the most indefatigable workers in the cause of co-partnership, not only in Great Britain, but in one of our

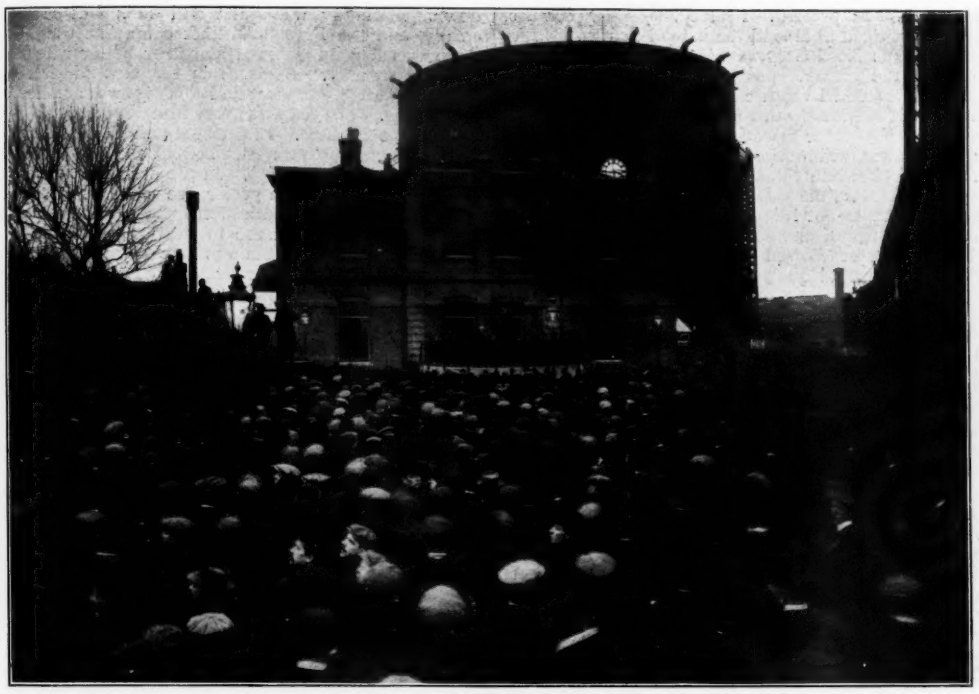


THE UNVEILING OF THE LIVESEY STATUE AT THE OLD KENT ROAD GAS-WORKS.

[From a Photograph by the London News Agency Photos, Limited.]

dominions beyond the seas, the Dominion of Canada, from which he has just returned with the well-earned laurels of a successful administration. Some seventeen years ago, Lord Grey was the Chairman of the first International Co-Partnership Commission ever held, which took place in London; and from that time he has never lost an opportunity of pressing forward and advocating, with earnestness and strenuousness, the great claims of co-partnership, in order that advantages may accrue from it in dealing with the problems of to-day. I am sure I feel, and you will all feel, very highly the honour he shows us to-day in coming here to perform this ceremony. No one, as I have said, to our way of thinking, is better qualified for the task; and no one could have brought us greater honour than his Lordship brings us to-day in performing the ceremony. Without any more ado, I will call upon his Lordship to address the gathering.

Earl GREY: Mr. Carpenter, Ladies, and Gentlemen, Co-Partners past and present, and in case there is anyone here who is not among that number I will address myself to future co-partners as well—I wish first of all to congratulate your Company upon the fine corps of City of London Rifles, and on the most efficient body of St. John Ambulance men between whom I had the honour of driving up to this place. Co-Partners, I do not think that I have ever had a greater honour shown to me than that which has been shown to me by keeping the statue of Sir George Livesey veiled so long in order that I might have the great privilege of unveiling it. I had the pleasure of knowing Sir George Livesey for many years before I left this country for Canada. I had so great a sympathy with his work that I should have considered it at any time a privilege to tie his shoe-strings. That I should be called upon on this occasion to unveil the monument erected by his many friends and admirers, is, I can assure you, Co-Partners, the greatest honour that has ever been shown to me. Why do I say so? Because Sir George Livesey ranks very high among the men who are entitled to undying gratitude for invaluable service courageously rendered to struggling and suffering humanity. Sir George was a wise, a great, and a good man. Wise for having thought out a new way—not mechanical, but purely moral—for economizing the cost of production, to the common benefit of all concerned. He was a great man for the courage shown in forcing it upon the unwilling and the indifferent. He was a good man because his animating motive was not to promote the interests only of himself and his fellow shareholders, but to promote the interests of every single worker in the employment of the South Metropolitan Gas Company. I shall never forget as long as I live the tone of proud but humble content with which Sir George Livesey told me years ago that the spirit of brotherhood was so completely established in the South Metropolitan Gas-Works that he could be sure of finding in the home of every one of its 5000 employees the glad welcome of a co-partner and a friend. His heart seemed to be overflowing with real loving affection for every one of you; and I honestly believe the amount of bonus the employees received gave him greater pleasure than any increase in his own dividend. As you are aware, Sir George Livesey's whole life, from the time he was fourteen years of age to the day of his death, was devoted to the services of your Company. His value was quickly recognized. In 1871, he was appointed Engineer and Secretary; and through his influence the Company, in 1872, resolved to give their employees an annual week's holiday at double wages. In 1882, Sir George Livesey became a Director; and in 1885 he was elected Chairman, which honourable and responsible position he held, to your great advantage, until the unfortunate day of his death. Now, I am not going to refer to the ability Sir George showed in the mechanical improvements for which he was responsible, and which won for him a world-wide reputation in matters connected with the gas industry. It is his achievements in the field of moral development which will win for him enduring fame, and on which I should, with your permission, now like to make a few remarks. In 1876, through his influence, the consumers of the Company's gas were admitted as partners with the shareholders in the profits of the Company. In 1886, the first year of his chairmanship, Sir George Livesey admitted the officers and foremen to a share in the profits, along with the consumers and shareholders. In 1889—a year to which Mr. Carpenter has already referred—there was, as in the present year, a spirit of wide unrest which seemed to reign throughout the land. It was a year of general industrial disturbance. The time appeared to your benefactor to be opportune for inaugurating profit-sharing plans which had been in his mind for some years, with the object of raising the employees of the Company from the status of hirelings to that of partners. His proposals were received by some men as the light of a new day. Other sections of the men, however, had not at the time sufficient imagination to realize the advantage to themselves that would result from the adoption of co-partnership proposals. Because Sir George would not abandon his profit-sharing plans, a strike ensued. After two months' costly struggle, Sir George was victorious; and the profit-sharing principle was adopted which has made your works famous, and has throughout been continued with the most satisfactory result possible. Ever since the South Metropolitan Gas-Works have been an oasis of unruffled peace and brotherhood in surrounding scenes of strife and discontent. Sir George Livesey was able to point out year after year in his annual reports that, owing to the economical production of gas, which he attributed to the spirit of brotherhood existing between the men and the management, a sufficient profit had been secured to enable the Company to do what seems to be almost impossible—namely, to pay to their employees a higher wage than that received by any other gas workers in the kingdom, and to pay a higher dividend to the shareholders than that received by the shareholders of any other Metropolitan gas company, and at the same time to sell the gas manufactured here at a price below that charged by the other companies. That this treble accomplishment should have been successfully achieved would appear to the ordinary man an impossibility; but, impossible as it would appear, this was the demonstrated result year after year of a system which recognized and endeavoured to promote the interests of all concerned. The marvel is not that the establishment of a righteous system secured great results far exceeding general expectation of what was possible, but the marvel is to my mind that the other gas companies and captains of industry in the kingdom refused to change their methods, notwithstanding the fact that you and your works had proved most conclusively the soundness of the new co-partnership system. Although three other gas companies adopted, to their permanent advantage, the Livesey principle in 1900 and 1901, ten



THE UNVEILING OF THE LIVESEY STATUE AT THE OLD KENT ROAD GAS-WORKS.

[From a Photograph by Borup, of Streatham.]

years after it had been established in your works, it was not until after Sir George's death in 1908 that the principle triumphantly demonstrated during his life to be one which was to the direct advantage of all concerned—consumers, shareholders, and workers—became gradually recognized as the right business principle for adoption in other gas-works. As so often happens, the voice of the Reformer spoke more potently from the grave than during life. Now, although he died only in 1908, a number of gas-works in the country have since adopted the Livesey principle. Thirty-one gas companies, with a capital of over £47,000,000, are now practising the co-partnership principles of your South Metropolitan Gas Company. The amount of bonus credited to the employees of the various co-partnership companies last year reached the large figure of nearly £89,000. It is, as you are aware, the general practice of these companies to give the greater part of the bonus distributed among their employees in the shape of shares, and thus enable them to capitalize their savings; and it is satisfactory to note that to-day, through the principle established at your works, the workers in the three great London Gas Companies have nearly £600,000 accumulated in the capital of the works in which they are employed. Now, I think I may say safely that the experience of these gas companies has proved conclusively that employers who have regard, not only to their own exclusive interests, but to the interests of their employees as well, benefit, not only the men, but themselves and society generally. At present it is not too much to say that our existing wage-system, under which wages do not fluctuate with profits, causes men to give ordinarily as little effort as possible in return for their wage, and, conversely, employers to give as little wage as possible for the services they receive. The result is a semi-paralysis of human effort. Sir George Livesey has proved that there are latent forces locked up in human bosoms that only require release to secure results which, to the so-called practical business man, appear impossible of attainment. We may regard Sir George as a pioneer who has discovered a new world. He has shown us how, in large works employing many thousands of men, a spirit of unity can be established between the management and the men, with results of friendliest co-operation and brotherhood, most beneficial to all concerned—shareholders, workers, and consumers. The value to the country which would result from the wide and successful adoption of the co-partnership principles that have found expression here, no one, however vivid his imagination, can venture to measure. Owing to the experiment of the South Metropolitan Gas Company—for the success of which you are all of you here responsible—there is a new light to-day upon the mountain tops; and it depends upon us all whether we shall follow the lead which Sir George Livesey and you have set us. If we are wise enough to do so, I venture to predict that this country is on the eve of great prosperity, and that the workers of the next generation will make as big a step forward as the middle classes did in the last. There is (and no one knew it better than Sir George) a beneficent law of Nature which has decreed that when social arrangements are founded on righteousness, they will work to the common benefit of all concerned. Sir George Livesey's experiment is an eloquent illustration of the invariable working of this law. It now only remains for us to popularize the teaching of his life—to popularize the teaching of the example you are setting the industries of this country—believing that, in proportion as the principles of these works are applied to industrial enterprise, not in a spirit of selfishness, but with the desire to safeguard and promote the interests of all, we may look forward with confidence to an ever-increasing measure of peace, happiness, and prosperity. (Loud applause.) It was a constant saying of Sir George Livesey that "No noble task was ever an easy one, and nothing good could be maintained without constant vigilance and earnest work." I could wish, Mr. Carpenter, it were possible that these words could be reproduced on some part of the pedestal of the statue which it is now my great honour to unveil.

Earl Grey then, amid prolonged applause, removed the covering from the statue.

Mr. Frank Bush: Earl Grey, Ladies, and Gentlemen,—I have been asked, as the Deputy-Chairman of this Company, and as one of Sir George Livesey's oldest friends, to propose a vote of thanks to your Lordship for your presence here to-day; and I do it with great pleasure. I have also to thank you for your kindly, your felicitous, references to our dear and revered friend. My Lord, you have for many years taken a deep interest in co-partnership, and always in our own particular scheme. I remember being present with Sir George Livesey at Newcastle some twelve years ago, when he read a paper on the subject. You had just then been elected President of the Labour Association; and I listened to your address with deep pleasure. Will you allow me very briefly to remind you of one or two sentences from that address? This is what you said: "The members of the Labour Association might have found it easy to appoint to the office of President an abler man than he could pretend to be; but he did not honestly believe that it would have been possible that they could have found anyone who had a more thorough conviction than he had that it was not only desirable, but almost necessary in the best interests of society, that the principles of co-partnership should be widely adopted by employers and employed, and applied by them in a generous spirit of mutual confidence and goodwill to their various industries." You have never faltered or wavered in that view; but as time has gone on, your faith and belief in co-partnership have increased. It must have been a great pleasure to you to have heard from time to time during your sojourn in Canada of the strides that co-partnership was making in the gas industry, and of the flourishing condition of the scheme initiated by Sir George Livesey. Of its applicability to other businesses there can be no doubt. Would that it could be tried! Just a few words more. Someone has said—and I think wisely—"There is wisdom in memorials." Let me conclude by saying that I think it is right and fitting that in these works, where Sir George passed most of his youth and practically his whole business life, this statue should have been erected. No more appropriate site could have been found; and certainly no one more appropriately than yourself could have unveiled it. (Applause.) If later on it should be thought desirable to add to the inscription, might I suggest Longfellow's words—

"So when a great man dies,
For years beyond our ken,
The light he leaves behind him lies
Upon the paths of men."

My Lord, let me again thank you, and let me say how much we are indebted to you for your presence here to-day. This feeling,

I am sure, is shared by all present. I have very great pleasure in asking Lord Robert Cecil to second the vote of thanks.

Lord Robert Cecil: Lord Grey, Mr. Carpenter, Ladies, and Gentlemen,—I have the greatest possible pleasure in seconding this vote of thanks; and I venture to say to Lord Grey that, great as have been his services to this country in various capacities, I doubt very much whether there is any single action which, if our wishes are fulfilled, will more redound to the prosperity of the country than the proceedings of this afternoon. I had, for the last few years of his life, the honour of the acquaintance of Sir George Livesey. It is not for me, in an assemblage such as this, to attempt a eulogy of one whom you knew better than I did; but this much I may be allowed to say: He had great moral qualities and great intellectual qualities. But the greatest of all was, in my judgment, the directness of intellect which enabled him to seize the true bearings of any problem that was submitted to him, and to judge of it fairly and freely without prejudice or partiality. He had also, as we all know, great courage; and it was the union of these qualities which enabled him to devise and to carry out this system of co-partnership which, I am convinced, holds the secret of the solution of our industrial problems—if any solution is to be found. I will not attempt to detain you this afternoon with any lengthened observations; but I do wish to say this: Do not imagine that co-partnership is merely profit-sharing. That was one of the great truths of which Sir George Livesey had a firm hold. You must have, not only a share of the profits, but you must have also a share of the capital and a share of the responsibility. It is the union of these three elements which is at the base of all true co-partnership; and it is by the adoption of this principle in the industrial life of the country that we may seek, and hope to secure, a peaceful issue of the present very threatening condition of affairs. I do not say—for I am not an alarmist—that we are on the eve of revolution; but I do say that the present industrial organization of this country has either broken down or is on the verge of breaking down, and unless we can find some solution of a peaceful character the near future of this country does not appear to me to be otherwise than ominous. I am convinced that the solution is to be found in co-partnership; and it is therefore a matter of the keenest satisfaction to me to find myself on the platform taking part in a ceremony which is to do honour to the memory of the greatest pioneer of that idea. (Loud applause.)

The vote of thanks having been carried with cheers, and to the accompaniment of a spontaneous outburst of "For he is a Jolly Good Fellow,"

Earl Grey said: Ladies and Gentlemen,—I thank you most heartily from the very bottom of my heart for the extreme kindness of your reception of myself. I am grateful to you for the way in which you have sung your thanks, as well as cheered them. I wish—though I must occupy your time no longer—to congratulate, if I may do so, the Sculptor, Mr. Pomeroy, upon the extremely good likeness of your benefactor and founder, Sir George Livesey. I have seldom seen a statue which conveys a more true impression of the man himself. I congratulate you on having in your midst so excellent a likeness; and I hope it may inspire many generations to come with the ideals for which he is famous.

Mr. Carpenter: I do not think you will be satisfied if you do not take the present opportunity of making the acquaintance of Mr. Pomeroy, who is responsible for this work; so I will ask him to step forward and make himself known to you.

Mr. F. W. Pomeroy: My Lord, Ladies, and Gentlemen,—I thank you very sincerely for your kind reception of my work. I trust it will prove a worthy representation of the great man you all loved so dearly. Thank you very much.

At the conclusion of the ceremony, tea and light refreshments were served in the offices, after which visitors were afforded an opportunity to view the works.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 786.)

Our weekly comments upon affairs in the Stock Exchange seem doomed to be couched in mournful numbers. Week after week the chronicle has been one of persistent dulness and depression, and, unhappily, no change can be reported yet. Hardly any large department escaped; and the gilt-edged group were in the forefront of the flight. One potent influence to depress it was the number of new issues competing for favour, which drew away all support from old stagers. At the opening on Monday, a brave promise of activity and firmness was made; but quickly there came a lull, and then retrogression. Government issues closed weak. Consols lost $\frac{1}{8}$; and Railways were finally lower. Tuesday brought no general improvement; and one or two markets were weaker. Government issues were quite under a cloud, and Consols fell $\frac{3}{16}$. Rails were flat and falling, though the last prices were not the worst. Americans went up and down, closing on the down-grade. Wednesday was quiet and featureless. Rails did nothing, awaiting the result of the joint conference. Thursday was a thoroughly dull day. Gilt-edged things began it; Government issues being very weak, and Consols receding another $\frac{3}{16}$. All the rest followed suit. The tone on Friday was low, except for Rails, which backed a pacific issue of the conference. Consols and Americans were lower, and Foreign stocks almost uniformly down. Saturday was quiet and dull; but Rails were pretty steady, and the Foreign Market calm. In the Money Market, there was a good demand at rather better rates, and discount stiffened steadily. Business in the Gas Market was quite up to good average pressure; and dealings were rather more evenly distributed. The tone was very firm, and several quotations had a moderate advance. In Gaslight and Coke issues, the ordinary was brisk and strong; transactions showing the close limits of $104\frac{3}{4}$ to $105\frac{1}{4}$—a rise of $\frac{1}{4}$. In the secured issues, the maximum realized $85\frac{5}{8}$ to $86\frac{1}{4}$, the preference 103 and 104, and the debenture from 81 to 82. South Metropolitan was a shade more active, and changed hands at 116 to 117. The debenture made $79\frac{1}{2}$. In Commercials, business was marked in the 4 per cent. at 110 and $110\frac{1}{4}$; in the $3\frac{1}{2}$ per cent., at $105\frac{1}{4}$; and in the debenture, at $76\frac{1}{4}$. Among the Suburban and Provincial group, Alliance and Dublin was done at $80\frac{1}{2}$, Bournemouth "B" at $16\frac{5}{8}$ to $16\frac{1}{4}$, Brentford new at 199 free, British at $45\frac{1}{8}$ and $45\frac{1}{4}$, Brighton ordinary at $158\frac{1}{2}$, South Suburban at 122, and Southampton at $107\frac{3}{4}$—a rise of 1. On the local Exchanges, Newcastle was marked at $101\frac{1}{2}$, and Sheffield "C" at 240—a rise of 1. In the Continental companies, Imperial was in demand at higher figures and realized from $185\frac{3}{4}$ to 188—a rise of 2. European changed hands at 20 to $20\frac{1}{4}$, and Malta at $5\frac{1}{16}$. Among the undertakings of the remoter world, Buenos Ayres debenture was done at $96\frac{1}{2}$ (a rise of 1), Hong Kong at $17\frac{1}{2}$, Monte Video at $12\frac{1}{8}$, Primitiva at $7\frac{1}{16}$ to $7\frac{9}{16}$, ditto preference at $5\frac{3}{16}$ to $5\frac{11}{32}$, and River Plate debenture at $96\frac{1}{4}$ and $96\frac{3}{4}$—a rise of 1.

ELECTRICITY SUPPLY MEMORANDA.

More Municipal Licence Required—Amending General Legislation through a Private Bill—Departures from the "Model" Fittings Clause—Suggested Unprecedented Liberty—Support Refused by Brighton—Train Lighting—Fused Wires at the Durbar and Elsewhere—The Ratepayers Pay—Projected Legislation.

The new Wiring and Fittings Bill of the Incorporated Municipal Electrical Association has been introduced into Parliament; and we foresee an amount of keen trouble in connection with it that has not been surpassed in any of the stormy parliamentary times through which electrical legislation has passed. We very much doubt whether Parliament will be prepared to accept this privately promoted Bill, inasmuch as, in nearly every respect, it is intended to amend or extend general electricity legislation, and to confer new powers upon many municipal concerns, whether or not the local authorities and the ratepayers are in favour. The promoting Association are asking for a guarantee fund of £3000 for the expenses; but judging from the experience when the Joint Standard Gas-Burner Bill was before Parliament in 1910—the opposition of a few authorities alone costing £5308—the promoters may regard themselves as lucky if they get a contentious measure of this sort through for £3000. The Bill (*quâ* Private Bill) ought to be restricted entirely to those local authorities who are contributing to it. Otherwise, opposition could be brought against the measure from every town in which there is a municipal electricity undertaking; for there is not a municipal electricity concern in the country that has all the powers now sought. The Electrical Contractors' Association, it may be surmised, will not leave a stone unturned to raise up prodigious opposition to the measure.

The promoters are opening their mouths very wide in asking for practically uncontrolled liberty. If Parliament gave the Bill as it stands to the municipal section of electricity undertakings, Parliament would be conferring an unprecedented freedom on a statutorily authorized industry. The measure, it is proposed, shall apply to "any" local authority authorized by Act of Parliament or Provisional Order to supply electricity. The first request is that power shall be vested in local authorities to provide, sell, let for hire, and fix, repair, maintain, and remove, lamps, meters, electric lines, fuses, switches, fittings, lamp-holders, motors, and other fittings for lighting, heating, and motive power, together with the provision of all materials and work, and may take such remuneration, or rents and charges, and make such terms and conditions as may be agreed upon. Now this power ought not to be allowed without the stipulation that the amount received for electricity under any schemes promoted under the power is equivalent per unit to the sum received per unit for lighting, heating, or power, from the ordinary private consumers; and safeguards should be provided to ensure that this is done. Otherwise, the protective provisions that Parliament insists on might be rendered absolutely nugatory. These provisions are, as it is, modified in the Bill. There is the one as to the adjustment of the charges for fittings being made so as to meet expenditure. This is extended by the quoted words: So as to meet "in the aggregate" any expenditure made under the powers of this section. This is a departure from the model clause. The words "in the aggregate" will facilitate a liberty that is undesirable as between consumer and consumer. The same in the succeeding provision, regarding the statement of every sum charged being mentioned on the demand notes delivered to the consumers. The "model" provision is extended by the words "unless such sum is included in the price charged by the undertakings for electricity." It seems to us that everything possible is being done by the promoters to defeat the object of these provisions. The omission of the provision, too,

as to work and sales being through a contractor is another departure from the "model."

Next the Bill proposes to invest local authorities supplying electricity with unlimited spending powers for showrooms and exhibitions, and to enable them, by public advertisement or otherwise, to publish and make known "any matters connected with, or affecting the sale of, electricity," as well as to authorize them to do all such other acts as they may deem expedient to assist, develop, or promote the use of electricity." The words "lawful and moral" ought to be inserted before the word "acts." A stand-by clause is included in the draft Bill, which clause, it is purposed, shall apply to premises having a separate supply of energy, "electric or otherwise." We have no objection to the "otherwise," provided that Parliament will not, as they have done in some (not all) cases of late, cut out "electricity" in the stand-by clauses of gas authorities, or, as in the Swansea Gas Bill, exempt "domestic" stand-by service. Then it is intended that local authorites shall be authorized to pay out of the revenue of the electricity undertakings reasonable expenses connected with attendance at conferences and subscriptions to associations. The succeeding provision is to give the right, if the undertakers think fit, to carry net surpluses of revenue and the annual proceeds of the reserve fund, when amounting to the prescribed limit, to (instead of aiding the rates) any of the purposes of their undertaking, including the formation of a fund for working capital —"providing that the funds so formed shall not at any time exceed a sum equivalent to one-half of the gross annual revenue of the undertaking for the time being." It may be doubted whether Parliament will be prepared to sanction the perpetual provision of working capital out of revenue in this way. Then the promoters desire a second string to their "working capital" bow. They suggest that—contrary to the practice of Parliament, and to the recently expressed view of the parliamentary authorities that capital limitations should be put upon municipal trading concerns, so that their affairs should come up for reasonably frequent review—municipal electricity undertakings should be given the right to borrow working capital at any time they please —not as sanctioned by Parliament, by Bill, or by the Board of Trade by Provisional Order, or by the Local Government Board after inquiry, but as the local authorities "may think fit." The clause is novel; and so here it is:

7. (1) The undertakers may *at any time* borrow for the purposes of working capital in connection with their undertaking any sum or sums not exceeding in the whole one-tenth of the amount expended by them upon the purchase of lands, and the construction of works for the purposes of their undertaking prior to the expiration of the period of three complete years after they shall have commenced to work the undertaking, or one-tenth of the amount which they shall have been authorized to borrow for the purposes of their undertaking prior to the expiration of that period whichever amount shall be the larger.

(2) The provisions contained in the Electric Lighting Acts relating to the borrowing of money by local authorities shall apply to the borrowing of money by the undertakers under this section as if they had obtained the consent referred to in section 8 of the Electric Lighting Act, 1882. Provided that: (*a*) Any money borrowed under this section shall be repaid within ten years from the date or dates of borrowing. (*b*) It shall not be obligatory upon the undertakers to commence such repayment by means of a sinking fund or otherwise, until the expiration of two years from the date or dates of borrowing.

This is a singular suggestion; and we fear that it, with other of the proposals contained in the Bill, will prove unacceptable to Parliament, and that the reports of the Board of Trade and the Local Government Board upon this, as well as other of the suggestions, will be unfavourable. The promoters are asking for too much freedom. There is, however, one clause that ought to be passed without amendment; and it is the one asking that section 4 of the Conspiracy and Protection of Property Act, 1875, shall be applied to electricity in addition to gas and water works. Electricity users ought to be protected against the danger of failure of supply through breach of contract by the electricity employees, more especially as they suffer the disadvantage of interruptions of supply (with the accompanying risks) which no Act of Parliament can prevent.

It has been a hard blow for the measure that the Brighton Corporation have refused to have anything to do with it, either in the way of supporting it by money or even influence. But the pragmatic promoting Association are proposing to confer on the Brighton Corporation among others the powers whether or not they require them; and, if Parliament passes the measure, the powers being there, those councillors who are in favour of extending municipal electrical speculation in this way will always be harassing the Council to put the powers into operation. Now a peculiar thing is that the Lighting Committee were in favour of extending financial support to the Bill, while the Electrical Engineer (Mr. J. Christie) was not. A further singular position of affairs is that Mr. Christie is the President of the promoting Association, or, at any rate, he was when they held their annual meeting in the summer; and a very reasonable thing is that a majority of the Brighton Corporation supported the views of their Electrical Engineer. We admire Mr. Christie for sticking to his views. He told the Association quite plainly in his presidential address a few months since that he was dead against this business. He then said: "If we embark in this retail trading, carrying out wiring installations, &c., to justify the existence of this new branch of our business, we must at times have to go into the highways and by-ways to obtain fresh consumers; and I fear that, by so doing, we will only boost-up an artificial and temporary demand, necessitating the raising of additional capital to meet it, seldom finding that it will yield an adequate return on the outlay incurred, and in the end doing our undertakings no real lasting good." We remarked at the time that this was well said, excepting that the "highways" ought to be all right, if the by-ways were not. At the Council meeting, there were a number of speakers in favour of giving support to the contemplated extension of municipal trading. But as the vote showed, the majority were opposed. Objection to the municipalization of everything, and to the trespass on the domain of private electrical contractors, were among the principal arguments. One speaker asked who, in the event of the Corporation going in for this work, would find the fittings and the renewals in the case of weekly property. One member's faith in electricity among the poorer classes led him to picture a reversion to gas within three months of installation, and the use of the electric wires as clothes lines. Another point was as to what would happen if a house were wired, and the next tenant desired to have gas, and when the landlord went to look for his fittings, he found them gone. The Town Clerk agreed that the Bill was silent on this point; but he assumed that in all cases local authorities exercising the powers in the event of the Bill passing, would secure the consent of owners before carrying wires into their houses. However, the main point is that the Brighton Corporation will not have anything to do with the promotion of the measure.

Mr. R. T. Smith has been reading a paper before the Institution of Civil Engineers on the subject of train-lighting; and he does not appear to have had his attention called to trial work that is extensively proceeding with inverted gas-burners using not oil gas, but coal gas. He states that, from a careful analysis of the cost of train lighting on the Great Western Railway, it appears that the working costs of a properly controlled self-lit electric system does not, for the same distributed illumination, differ very much from the corresponding working-costs of oil-gas lighting by incandescent inverted mantles. The haulage items also about balance. When, however, the annual capital charges, interest, and depreciation are added to the working costs, the cost of self-lit electric lighting compares unfavourably with oil-gas. We see there is first the condition for electric lighting that the locomotive power to drive the dynamo is to cost nothing; and even if this advantage were obtainable, capital charges, interest, and depreciation, prevent electric lighting competing with oil-gas lighting. But there is something else to be considered now, and that is the use of coal gas for the purpose, at (say) 2s. 6d. per 1000 cubic feet, as against 10s. for oil gas—the difference in consumption being as between 0·6 cubic foot of the latter per hour and about 0·9 cubic foot of coal gas. This, added to the other financial advantages, should further alter the complexion of Mr. Smith's figures.

The great Durbar at Delhi, in honour of the King-Emperor and Queen-Empress, was, towards the end of the preparations, marred by three alarming disasters. Last Tuesday, the extensive pavilion in which the Princes and Chiefs were to be presented to the King-Emperor was destroyed by fire, the fireworks intended for the King-Emperor's garden party also on the same day made a premature display, and large marquees in the Punjab Camp were destroyed on the previous Sunday. The "Times" Special Correspondent states that "the fire in the Punjab Camp resulted from the fusing of an electric wire in the roof of a marquee." We were not there, so can only quote the correspondent. Perhaps Mr. Renwick, the Chairman of the Electricity Publicity Committee, will confirm or deny the report. However, it could hardly have been expected by him or anyone else that the mania of electricity for fusing wires would not assert itself at the Durbar. "The Times" on Tuesday last week was also responsible for making a statement regarding the cause of the fire that took place at Kynoch's works, Witton, near Birmingham, the previous day, whereby estimated damage to the amount of £30,000 was occasioned. "The origin of the fire," says our leading morning contemporary, "is not definitely known; but it is supposed to be due to the fusing of an electric wire."

Different people look at things from quite different points of view. The Redditch District Council have been applying to the Local Government Board for sanction to a loan of £5850; and in connection with the extensions they are making, they will be discarding certain gas plant at the generating-station. This being so, there will be the plant for sale; and the Inspector at the recent inquiry pointed out that adding its estimated value to the loan would bring the latter up to £6194. On the other hand, though the Council will only realize about £344 for the plant, there is still £2384 outstanding on its cost, which the Board—the Inspector suggested—would require to be deducted from the loan. The Clerk to the Council, however, pleaded that this outstanding debt should be regarded as a set-off to expenditure that has been made from revenue for capital purposes. Now can the expenditure so made be fairly claimed to have been from revenue, seeing that the poor ratepayers of Redditch have had to contribute £13,000 towards the support of the concern since the Council foolishly entered upon this speculation? We should feel inclined to say that the ratepayers have been robbed for capital expenditure purposes in addition to paying some of the costs incurred in supplying electricity to those who patronize the concern.

There are not many notices for Electric Lighting Provisional orders for the coming session of Parliament; and most of those that have been given are for additional powers to existing authorized suppliers. There does not appear to be any great desire to exploit new areas. In quality, more important are the electric traction Bills which Parliament will be invited to consider.

PERSONAL.

Mr. CORBET WOODALL, who (on his doctor's advice) recently paid a visit to the South of Europe, has returned much benefited in health. As reported in another column, Mr. Woodall was able to attend the unveiling of the Livesey Memorial Statue at the Old Kent Road Gas-Works last Friday.

Mr. PERCY GRIFFITH, M.Inst.C.E., has recently been elected a Director of the Braintree and Bocking Gas Company.

Mr. C. W. BOYNS, who for many years was on the staff of Messrs. Cash, Stone, and Co., has been appointed Secretary of the Romford Gas Company, in succession to Mr. W. J. Harvey.

Mr. WILL DUXBURY, Assistant Gas Engineer at Londonderry, has been appointed by the Atherton (Lancs.) Urban District Council as Manager of their gas and water undertaking. Mr. Duxbury is a native of Darwen.

OBITUARY.

We regret to record that Mr. WILLIAM RUSSELL, J.P., a member of the firm of Messrs. Fletcher, Russell, and Co., Limited, died last Friday, at his residence "Cairnsmore," Manchester Road, Swinton, at the age of 67. He had been in failing health for about twelve months. Mr. Russell was a native of Glasgow; and after serving his apprenticeship as a pattern maker in Falkirk, went to Manchester some forty years ago, and soon afterwards, with his brother, started the business of Messrs. W. & A. C. Russell and Co., artistic ironfounders, at the Scotia Foundry, Pendleton. Commencing with only some half-dozen men, the firm soon developed; and for a great many years the Pendleton works gave employment to hundreds of skilled artizans. About twenty years ago, the firm was amalgamated with that of Messrs. Thomas Fletcher and Co., the bulk of whose castings had been made at the Scotia Foundry for a long time. Thus was formed the now well-known firm of Messrs. Fletcher, Russell, and Co., and eventually the Pendleton part of the business was transferred to Warrington. Mr. Russell had not for some time taken any active part in the management of the business. He was formerly a member of the Salford Town Council; but after a few years' service he resigned his seat on account of the increasing calls made on him by business. He was appointed a Magistrate for Salford in 1894; and at a sitting of the Salford Police Court on Friday, the Mayor (Alderman Lindley) made reference to the loss the Bench had sustained by the death of Mr. Russell, one of its oldest members. Mr. A. Spencer Hogg, the Stipendiary, in his tribute, said that Mr. Russell had indeed proved himself a very valuable public servant. Deceased leaves a widow and grown-up family.

By the death of Mr. JOHN KITSON, which took place last Tuesday, at the age of 75, a notable figure was removed from the public life of Torquay, and a long association with the gas undertaking of the town was finally severed. He was Secretary of the Torquay Gas Company for forty-four years; and when his elder brother, Mr. W. H. Kitson, died, he was induced to become Chairman—a position in which he continued until March last, when, owing to failing health, he retired. At that time he had rendered 51 years' continuous service to the Company. He was trained as a solicitor, and was a partner in the legal firm of Messrs. W. & C. Kitson, which was established by his father and his uncle, and also in the local banking firm of Vivian, Kitson, and Co., which was transferred to Lloyds Bank in 1901. For many years he was a member of the Local Board of Health, and for four years was the Chairman. During his connection with the Local Board, he was Chairman of the Water Committee, and took great interest in the various schemes which were discussed and adopted for ensuring an adequate supply of water for the town. His connection with the local governing body ceased in 1892, when Torquay obtained a Charter of Incorporation. His retirement was marked by the presentation to him of his portrait, painted by Mr. Arthur Hacker, R.A., in recognition of his many valued services to the town; and in 1909, the Corporation further expressed their appreciation of his worth as a citizen by electing him an honorary freeman of the town. At the meeting of the Town Council last Tuesday, a vote of condolence with the family of Mr. Kitson was passed. The funeral on Friday was attended by members of the Town Council and other leading inhabitants, as well as by Messrs. A. Iredale, W. Aitken, and J. F. Rockbey (Directors), Mr. R. Beynon (Manager), Mr. J. Duckworth (Accountant), and Mr. C. E. Martin (Auditor), representing the Torquay Gas Company.

"Mechanical World" Electrical Pocket-Book.—We have received from the publishers, Messrs. Emmott and Co., Limited, of Manchester and London, the above-named pocket-book for next year. As compared with its immediate predecessor, it has been enlarged to the extent of 16 pages; while considerable improvement has been effected in various sections of the book. The matter devoted to lighting has been entirely re-written, and the subject is now dealt with under two headings—"Lamps" and "Lighting." Tables have been added; and the contents generally have been thoroughly revised, and new illustrations introduced. The price of the book is 6d. net.

BURKHEISER'S PROCESS OF GAS PURIFICATION

Report of a Deputation of the Glasgow Gas Committee.

The following is the portion of the report on the Burkheiser process, referred to in another part of the "JOURNAL."

In the original Burkheiser process, the gas is treated by similar methods to those at present in use up to the outlet of the tar-extractors; but after those appliances the system of purification is much altered. The sulphuretted hydrogen is still extracted by oxide of iron; but this is prepared by a special process, and has much greater chemical activity than that generally in use. This activity and its granular form enables the gas to be purified at a greater speed, and also allows of the purifier boxes being greatly reduced in area compared with those required for equal quantities of gas by the old methods of purification.

After the oxide in a box is saturated or worked up, it is not removed and replaced by fresh material as at present, but is reconverted or regenerated back into oxide of iron, so as to be ready for further work without removal from the box. When this action has to be taken, the gas is shut off from the box, and a stream of air is blown through the material, which by a chemical reaction carries forward the sulphur in combination, leaving the oxide of iron in its original condition, and ready again for purification purposes. By careful attention to temperature, the mixture of air and sulphur leaving the box is in a suitable condition to produce, when passed through the necessary apparatus, a solution which takes the place of the sulphuric acid used in the production of the sulphate of ammonia in the chemical works.

Instead, however, of the gas being purified by the use of water in the ammonia scrubbers, the solution above referred to is employed to scrub the gas, and by its combination with the ammonia produces the sulphate of ammonia direct in the gas-works, without the necessity of producing the ammoniacal liquor and the trouble and expense of sending it to the chemical works to be worked up. The virgin liquor which is obtained from the foul mains and condensing plant is treated in a still, and the ammonia thrown off is sent forward with the gas to be dealt with at the same time as the bulk of ammonia in the gas, and so save extra handling and plant.

The process is a most interesting one; but a full description can scarcely be given in a report such as this. The plant is compact, and occupies much less space than the plant required for the ordinary purification of a similar quantity of gas and the manufacture of sulphate of ammonia. Though at the time of inspection no sulphate was actually being produced, the working of the whole process was examined in its various stages, and those in charge had every confidence in its successful results.

The plant described was seen in operation at the Flemalle-Grande Coke-Works, near Liège, though the original plant was put down at the Tegel experimental works of the City of Berlin. At Berlin, the original plant, after a great deal of experimental and careful work carried out to show the possibilities of the process, had been dismantled, and at the time of our visit had been reconstructed, and was then almost ready for further experiments. In the new arrangement of the plant, the purifier boxes with the dry oxide of iron had been dispensed with, and a special scrubber had been installed. In this scrubber the sulphur constituents of the gas are to be extracted by the oxide in solution passing through the scrubber; this arrangement, in conjunction with the apparatus for the removal of the ammonia, making the whole purification "continuous in closed vessels"—a problem the successful solution of which has been the aim of chemists and engineers for a very long time. The treatment of the oxide after use in the scrubber will be such as still to produce the acid solution or lye which is required for the extraction of the ammonia and the production of the sulphate in gas-works. These new and important improvements are expected to give more favourable results, and still further reduce the work and cost of purification.

The first, or what may be termed the dry oxide, process, from the published tests and experiments and from our inspection, seemed to offer advantages in the work of gas purification which were well worth full inquiry and consideration. In view, however, of the new or wet oxide process which has been evolved and is now under trial, the Sub-Committee recommend that it is not advisable, in the meantime, for the Corporation to instal any of the Burkheiser plants until further experience has been gained, and that all the information available regarding further tests of the process should be obtained, as it is probable it will have much influence on the purification of the near future.

The Yorkshire Junior Gas Association will meet at the Leeds Institute on Saturday afternoon this week, when Mr. W. Dawes, of Castleford, will read a paper on "The Construction of a Spiral-Guided Gasholder in a Column-Guided Holder Tank." This will be followed by a short paper on "Public Lighting."

Institution of Civil Engineers.—In a previous issue of the "JOURNAL," it was mentioned that Mr. Bernard F. Browne had passed the examination for associate membership of the Institution of Civil Engineers. At the meeting of the Institution last Tuesday, he was duly elected, as were also Mr. Alwyne Meade, of the Commercial Gas Company, Mr. S. T. Carthigasen, B.A., of the Water Engineer's Department, Swansea, and Mr. B. Norman Weekes, of the Water Engineer's Department, Liverpool.

STATUTORY GAS LEGISLATION AND MODERN REQUIREMENTS.

By Norton H. Humphrys, Assoc.M.Inst.C.E.

II.

The protection afforded by an Act of Parliament is largely discounted by the fact that the cost of setting the machinery in motion is considerable, to say nothing of some uncertainty as regards the ultimate result. Unless the question involved is of widespread importance, affecting a large number of transactions, it is not worth the trouble of obtaining a decision; and this applies alike to companies and to private individuals, except that the latter are always sure of a certain amount of sympathy, based upon the fact that it is an onerous task for an individual to fight a wealthy company. If he loses his case the consequences are serious—perhaps ruinous; whereas the company do not suffer much inconvenience if they lose. On this account, the individual enjoys some advantage, and the company a corresponding disadvantage, in the Law Courts. An Act of Parliament, in practice, is like the County Court, which is only useful for recovering debts from people who would in any case pay up as soon as they were able.

In the early days of gas lighting, it was a usual practice for each new customer to sign an agreement; but with the general adoption of statutory enactments, the practice fell into disuse as being superfluous. Failing any special enactment, the agreement form is generally adopted for the slot consumer, with the result (as shown by experience) that a properly drafted agreement—a copy of which is furnished to the consumer—is a more useful weapon than clauses in the Special or General Act. A valid agreement is quite as binding and much easier to act upon. A magistrate may disagree with the terms of the agreement, but cannot gainsay it. The number of disputes arising out of such agreements that find a place in the "Legal Intelligence" columns of the "Journal" are much less than those which arise with the ordinary or parliamentary consumer, though there are obvious reasons for expecting them to be more numerous.

One reason for the ineffectiveness of parliamentary regulations is the fact that the "man in the street" is as ignorant of them as of the Chinese language. In theory, they are a matter of common knowledge, and ignorance is no excuse. They are open for public inspection at various public offices, and are on sale at the bare cost of printing. More than this, the penalty clauses are posted at the gas-works offices, or possibly on the back of every account rendered. But not one consumer in a thousand knows or cares anything about them; and, apart from the officials interested, they might as well be out of existence. We never find the notice boards at the gas-works surrounded by an eager crowd. They are not read through once in a month; and if a visitor, while waiting for a few minutes, happens to cast a casual glance at them, it is without any recognition of their effect as regards himself or anyone else. Where it is the practice to print short abstracts on the face of the quarterly accounts, it is no uncommon thing to find consumers of twenty years' standing who have never read them or noticed their presence. But if a man is asked to sign an agreement, he carefully makes himself acquainted with the contents before affixing his signature at the bottom. The advantage of the agreement, as compared with the statutory regulation, is that both parties are fully acquainted with it.

An agreement must necessarily be drawn in clear, everyday language, plain, carrying but one meaning, and easily understandable by both parties. But an Act of Parliament may be so overloaded with legal phraseology as to be seriously defective in this respect; and some of the provisions for the supply and sale of gas are notable offenders—various authorities having given divergent decisions upon them. There is no reason why the regulations for the use of the public roads for carrying mains should not be so drafted as to leave no room for misunderstanding or dispute. Clearness and decision are especially desirable in dealing with matters affecting the rights of other public companies, or in respect to which local authorities, either on their own behalf or as spokesman for consumers, claim to say something.

One might reasonably suppose that the supply clauses from the Special Act would furnish a basis for the agreement form. But they are entirely one-sided; being drawn up in favour of the local authority first and of the private consumer second. One point that is evident on perusal is an assumption running through the whole, to the effect that the interests of the local authority and the private consumer are identical, and that the one represents the other. In Parliamentary Committee rooms and elsewhere, the local authority pose as champions of the consumer. But the two interests are not necessarily identical throughout, and in some respects are conflicting. There is such a thing as favouring the local authority at the expense of the consumer, and the General Acts are strongly tinged with it. There is also too great a tendency to think of the rights or of the advantage of the consumer as an individual, rather than of the rights of the whole. Not only the local authority, but the individual consumer may receive an unfair advantage at the expense of the whole body. Any person in the district can press for a supply, incidentally involving a definite outlay on the part of the company, but without anything like a sufficient guarantee that such outlay shall really be remunerative. Especially does this apply to long services or even special mains for public lamps. As a matter of theory, unprofitable business of any kind is a loss to the seller only; but in practice, the buyer pays the whole, or a considerable part, of the loss. The individual trader would regard it not as a special first charge on his profits, but as an incidental expense in the conduct of his business, and regulate his selling prices accordingly. In the case of a gas company paying a limited dividend, the consumer obviously pays the whole. One company may have £1000 a year in the way of unprofitable business, and another have nothing of the sort worth the name; and both are paying 10 per cent. on the paid-up capital. The second can sell cheaper than the first; so it is obvious that the consumers pay the whole of the £1000. Regulations that force unprofitable business are in no sense in the interest of the consumers.

This is not a matter touching the interests of the company chiefly, but it is more intimately connected with the large users and the gas consumers generally. They directly bear either the whole or the greater part of the burden, according to the regulations under which gas is sold; and the suppliers are only indirectly interested by the loss of such additional business and stability as might be secured by a lower selling price. Given a fixed rate of dividend, it follows that any additions to the expenses caused by parties whose consumption is not sufficient to cover the cost of service, establishment expenses, an aliquot share of the unaccounted-for gas, and other matters, that it may be properly regarded as "cost per consumer," must go to swell the working costs. The unprofitable consumer is a parasite, supported by the profitable consumer and not by the company. The cost per 1000 cubic feet at the consumer's meter being increased, the selling price must be raised to a corresponding extent. Ten per cent. on the first outlay and 10 per cent. on annual expenses, may mean as much as 3d. or 4d. per 1000 cubic feet, which touches a large consumer heavily, and may mean all the difference when there is a choice between gas and some other agent for light, heat, or power. In the interests of both parties, means should be provided by which the hopelessly unremunerative lines can be lopped off, like a dead leaf or branch. If an ordinary tradesman has a customer who for any reason comes under the unprofitable class, either by requiring insignificant quantities or expecting more attention than the business warrants, the custom is more or less politely declined. Gas companies should have a corresponding power, which might take the form of a maximum charge on each size of service-pipe or meter fixed.

Here is one example of the confusion that has arisen through the mixing up of the interests of the local authority and individuals, as being identical with those of the consumers as a whole. Stand-by or intermittent users were not contemplated by the Gas-Works Clauses Acts, which are based on the assumption that every consumer will take a regular supply. But for one reason or another, in every district there are no inconsiderable number of this class. The service can be had free of expense, the meter-rent is a mere trifle, and so they think it a wise precaution to have the gas laid on, although they intend to use it as little as possible. Perhaps it is required for gas-fires only, that are not wanted at all during one half of the year, and very irregularly the other half; or a gas-engine that is run for two hours a week; or some technical apparatus that is only used for a few minutes at rare intervals. The great difficulty in connection with this class of business is that the mains from the works and the supply pressure must both be equal to the maximum demand so as to avoid complaints of poor supply. Consumers of this class are apt to expect as much consideration as regular users, and they should be made to clearly understand their position. There is more than an accidental connection between the unprofitable consumer and the unaccounted-for gas. It is obvious that the larger the meter and service furnished to the stand-by "consumer," the greater will be the loss. A ¾-inch service and 3-light meter may not be of much consequence. But it is different with a 3-inch service and 200-light meter.

There is another hardship that, like the unprofitable customer, tends to increase under modern conditions, and that is the lack of control beyond the meter. Any person is free to use gas in a way that may be not only costly, unsatisfactory, or dangerous to himself, but a serious injury to the use of gas generally, and to the gas company in particular. Some years ago a church was being reconstructed, and among other innovations the architect designed a pair of handsome pulpit lights in peculiar antique style, something like a watchman's lantern. The appearance was good, and in harmony with the general style of the building. But the architect was apparently innocent of any knowledge as to the elementary principles of combustion, and had provided no air supply other than that afforded by an openwork top. The result was that a proper supply of air could not get to the flame, and when the lights were in use a cloud of visible soot, and evil-smelling products of combustion, came out of them, to the great annoyance of the preacher. A churchwarden who happened to be largely interested in a competing venture, did not hesitate to blame gas, rather than the ignorant architect who was the real culprit, with the result that gas was turned out of the church, and has not been used in it since. Morally, the gas company had a good claim for damages against the architect. In another church, the organ loft was lighted by a very old open fishtail gas-burner. One Sunday morning, in consequence of a passing cloud, the organist suddenly jerked the tap full on, with the result that a roaring flame was produced, several inches in length, and the glass globe broken. No other lights being in use at the time, the solitary burner got the full benefit of a liberal Sabbath morning cooking pressure. In this case also the gas was blamed for the trouble, and was

summarily banished from the organ loft without a chance of a word in defence.

We often hear the "man in the street" talking about "bad gas," but rarely about "bad fittings;" and one of the subjects awaiting the labours of the British Commercial Gas Association is the dissemination of sound accurate knowledge on this important point. It is impossible to get a satisfactory supply through badly worn or badly designed appliances. But if a customer's supply is from any cause defective or insufficient, the chances are he takes up some parrot cry about the gas being adulterated with air or made from inferior coal, or that the system of distributing mains is at fault. One wonders sometimes at the amount of ability that is lost to the profession, as it is no uncommon thing to meet with people who, according to their own account, could sell gas at half the price and make a double profit. So far from objecting to reasonable complaint, it should be encouraged. "If you are pleased with our goods tell your friends; if not, tell us"—is a sound business maxim. It would be unwise to hold the gas and gas company as being beyond reproach; and the additions and changes that come about in course of years may necessitate corresponding alterations to the mains. The point to be considered is not what the pressure at the consumer's meter was five years ago, or one year, but what it is now. But the objectionable feature is the unreasonable complaint, and to judgment going by default, without any chance whatever of advancing a fair defence.

In addition to defects in regard to consumption, a very common complaint is leakage. In some districts this is so common as to be a serious disadvantage, because people are led to believe that the odour of escaping gas is an unavoidable incident, only to be got rid of by cutting off the pipes at the boundary of the premises. The tendency to increased supply pressure continues to grow. At the time of the Gas-Works Clauses Act, the popular cry was "too much pressure." It was supposed that the sole object was to make the meter work. Now it is the other way about. The supply pressure has crept up to double and even threefold, the limit of the gasholder pressure has been approached, the station governor is a superfluity for at least six hours out of the twenty-four, and the upper lifts of the gasholders are useless. The assistance of machinery of the fan or booster type is gradually making itself felt. No corresponding improvement in the gas-fittings has followed; on the contrary, the demand for cheap and flimsy stuff increases. The result is continual complaints of leakage, sometimes to such an extent as to be a source of danger. The gas company may endeavour to minimize the trouble by attending to leakages free of charge; but they cannot make old stuff into new, or gossamer work into a substantial article. There is a great need for a modern Alladin in the old-fashioned districts to-day. Systems and fittings are retained in use, and can claim quite a venerable age. Not only have they accumulated all the infirmities incidental to a long life, but they were not set out in the first place to stand the pressures usual to-day.

Any agreement as between the company and the consumers, either individually or collectively, should include, in addition to the usual clauses for the benefit of the consumer, relating to price, pressure, and purity, clauses embodying the questions just noticed —such as minimum consumption, control up to the point of ignition, and the right to refuse supply to any appliance likely from any cause to give gas a bad name. Such an agreement will be more satisfactory to all parties concerned than the clauses of an Act of Parliament. And there should be a prescribed maximum and minimum consumption for each size of meter.

Gas from Sewage Sludge.

In recent issues of the "Chemical Trade Journal," reference was made to a so-called "new" process for producing gas from sewage sludge; and in the course of some editorial comments in the pages of our contemporary, in which doubts were expressed as to the feasibility of the general adoption of this mode of disposing of sludge, the following remarks were made: "Whatever may be the possibilities in that direction on the Continent, the manufacture of gas from sludge in this country would be impracticable. Nearly all our gas-works are municipal property, and produce a large revenue, which goes considerably towards the reduction of the rates. The amount of gas required is limited to the requirements of the respective towns, and whatever quantity would be produced from sewage sludge would reduce that quantity, and therefore also the revenue from the gas-works. It would therefore simply be a policy of robbing Peter to pay Paul to adopt a system of producing gas from sewage sludge. Apart from these objections, it must be borne in mind that sewage works are generally situated a long distance away from the towns, and that there would be considerable difficulties in the arrangements which would have to be made for the distribution of the gas. As a matter of fact, there is nothing new in the process which is now boomed to a great extent on the Continent. As far back as 1898, Dr. Grossman read a paper on this subject before the Society of Chemical Industry, and showed that theoreticaliy it might be feasible to produce gas and ammonia from sewage sludge at a profit. From a paper, however, published by him in the 'Journal of the Society of Chemical Industry' in 1905, it appears that he had then already abandoned the idea of using sewage sludge as a means of producing gas, practically for the same reasons as those which we have given."

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held last Saturday afternoon, at the Technical School, Suffolk Street, Birmingham—Mr. R. J. Rogers (the President) in the chair.

Mr. Bywater's New Appointment.

The Hon. Secretary (Mr. W. J. Pickering), having read the minutes of previous meetings, said that he had written to Mr. F. J. Bywater, in accordance with the resolution passed at the October meeting congratulating him on his appointment to East Greenwich. In reply to this letter, Mr. Bywater wrote: "Please convey to the President and members of the Junior Association my sincere thanks for their very kind resolution of congratulation and good wishes, which I appreciate very highly. It has always been a source of great pleasure to me to remember that I had some small share in the formation of the Midland Junior Association; for the technical value of the papers and the discussions thereon, together with the whole tone of your meetings, betoken ability and keenness which must prove of very great benefit to the members themselves. I shall always look back upon my association with the Midland Juniors with the greatest pleasure; and in saying *Au revoir* to them for me, I shall be glad if you will convey to them my sincere wishes for their individual and collective good fortune."

Mr. Smart's Resignation—Alterations of Officers.

The Hon. Secretary (continuing) referred to alterations which had been made in the officers of the Association, consequent on the appointment of Mr. W. S. Smart as General Manager to Messrs. W. J. Jenkins and Co., of Retford. He explained that Mr. Smart wrote tendering his resignation of the office of Senior Vice-President of the Association and member of the Council. When the Council met, it was proposed, and agreed, that the resignation be accepted, that Mr. Smart be congratulated on his new appointment, and that the best wishes of the Association be tendered to him. The Council desired to place on record their appreciation of the work done by Mr. Smart while a member of the Council, and during the whole lifetime of the Association. Arising out of the situation thus created, Mr. F. Shewring (Droitwich) had been promoted to the position of Senior Vice-President, and Mr. W. H. Johns (Saltley) had been elected to be Junior Vice-President. This had created a vacancy on their Council; and Mr. B. J. Bell (Birmingham) had been elected to fill this, with a term of office of two years.

Coal Gas Purification.

Mr. Harold E. Stone, of the Central Laboratory, Birmingham, then read a paper on "Coal Gas Purification." This, together with notes of the long discussion to which it gave rise, will be found on pp. 961-5.

Coffee Meeting.

At the close of the business meeting, a Coffee Meeting (for which a musical programme had been arranged) was held at the Metropole Restaurant.

PRODUCTION OF POWER FROM GASES.

A Lecture by Professor Burstall.

Last Tuesday, Professor F. W. Burstall, M.A., delivered in Birmingham the second of the course of six lectures* on the "Production of Power from Gases," which is being given to the Midland Junior Gas Association, under the auspices of the Midland Association of Gas Managers. A large number of members of both Associations were present.

The opening portion of the lecture dealt fully with the details of modern gas-engines. After a few words as to the history of the gas-engine, and the form which it has taken since its introduction, the lecturer said: It will be well for us to consider what exactly the problem is in the construction of a gas-engine as against the construction of a steam-engine. First of all, we must consider the nature of the fluid that is actuating the engine. In the steam-engine, we have an elastic vapour which has certain lubricating properties. In the gas-engine, we have, for the most part, air which performs the operation of actuating the piston; and it is air which contains other gases (such as carbon dioxide) and these gases are of a very harsh and cutting character. So that the problem is materially different from that point of view. Again, in the steam-engine the elastic vapour is admitted through the slide-valve from the boiler, and the pressure acts steadily on the piston without any shock. In the case of the gas-engine, there is a shock coming on to the piston in a few hundredths of a second. At full load, we may have from 100 to 150 tons, in the case of big engines. In the third place, the temperature of steam is fixed, never exceeding 400° Fahr., except for superheat. In the case of gas, we have a very high temperature—3300° to 3500° Fahr.—

* The first lecture was reported in the "Journal" for Nov. 14, p. 469.

developed inside a metal envelope, which, of course, makes a material difference in the construction of the engine.

Proceeding, Professor Burstall gave his audience illustrations and descriptions of large and small English and Continental gas-engines—explaining the differences in construction. Referring to the tandem two-cylinder type, he said: This is a type which was introduced in order to get a bigger and cheaper engine, and also better running, and is what is known as the tandem—two cylinders one behind the other, driving on a common crank-shaft. There is one crank, flywheel, and connecting-rod to take the force of the explosions of both cylinders, which means a saving in weight. Originally, the method of getting the same result was to have two cylinders facing one another, and driving on to a common crank-pin. Now when this tandem type was evolved, it happened that the suggestion was made to use horizontal valves; and these valves have been employed fairly extensively. The only objection, of course, is the question of the wear of the stalk. Experience shows that the wear in very long slides is practically negligible. It has the advantage of giving a comparatively symmetrical cylinder, and no possibility of any gas remaining in the interior of the engine unburnt. This type has only been used by one or two firms; but it possesses real advantages.

The concluding portion of this second lecture was as follows: What I cannot help considering the greatest drawback to the gas-engine is that when we attempt to get any material power out of it—and 2000 H.P. is not a very big power—we are faced with the problem of great length and great weight, which means that the use of gas-engines is limited to places such as steel works, where land has no great value, and where economy may be effected by the use of blast-furnace gas. It seems tolerably clear that, if the gas-engine is in any way going to supplant the steam-engine for universal purposes, it will have to be got down into a lighter and more compact form, and also run materially faster than it does at present.

There is not much difficulty now in running up to some 300 or 400 revolutions per minute in the case of a small engine. But with tandems, we have very heavy weight—the weight of rod, weight of pistons, and weight of water; and this reverses its direction of motion every stroke. This reversal gives rise to inertia stresses; and these inertia stresses do not increase directly with the speed of the engine, but increase as the square of the speed, with the result that we cannot run at a very large number of revolutions per minute without knocking the engine completely to pieces. There is a still further limitation of speed when using blast-furnace gas and producer gas, because the inflammation is not as rapid as is the case with ordinary retort gas. They ignite comparatively slowly. Hence, at a speed of from 500 to 600 revolutions per minute, the ignition and combustion are not completed until the exhaust-valve opens, which, of course, means loss of efficiency, and would virtually put the gas-engine completely out of court.

One of the difficulties that is experienced in gas-engines is due to the fact that, when the exhaust-valve closes, there is still some unburnt charge in the cylinder; and, as far as possible, you want to get the whole of the charge out of the engine, so as to obtain a bigger charge of fresh air and gas. One of the devices for removing this is by means of what is called a scavenger charge. The scavenger cylinder is simply a cylinder of rather larger diameter, the interior portion of which acts as a kind of air-pump. While the exhaust-valve is open, the inlet-valve is open, but the gas-valve is shut. With the piston travelling in an inward direction, the pump forces air down into the cylinder, and sweeps out the unburnt gases into the exhaust-pipe. It not only sweeps these out, but also cools the surfaces, and helps to prevent any form of premature ignition. When the exhaust valve closes, the mixing-valve opens, and the charge of air and gas is admitted.

Now I want to say a few words about ignition. The first ignition was an electrical device, which was used by Lenoir. This was abandoned, because of the difficulty of getting a regular spark. The next method was a very ingenious one which was the device of Dr. Otto, and consisted in carrying a little plug of burning gas from an external gas-jet through into the cylinder by means of a slide. It was an exceedingly good device, so long as the compressions were kept down to something like reasonable limits. The slides for high compressions that were adopted were always unsatisfactory and leaking; so that when the compressions were taken up above 40 lbs., the slide had to be abandoned.

Following this, in 1886 the use of the hot tube became general. This was either of porcelain or some metal alloy heated externally; and the charge which entered the inside became ignited, and spread back into the cylinder. This method is still found in a number of engines; and it has not been entirely superseded by other methods. But with this method the ignition is not quite hot enough, as we have to get the tube red-hot to ignite the charge; and that is not sufficiently high to ignite the weak charges we are using at the present day. Hence, we have got one or two other methods of ignition. One is known as the magneto, and the other as the high-tension. The result in both cases is the same—namely, the production of a very hot spark in the interior of the cylinder. But there is the difficulty that the points in the case of the magneto are liable to wear away with the constant passage of the spark, so that in certain conditions the points themselves become extremely hot, and set fire to the charge. The high-tension is probably the best method for use where experienced people can be obtained; but for ordinary commercial needs, there is no doubt that the magneto is the correct system.

INSTITUTION OF WATER ENGINEERS.

The First (Winter) General Meeting of the newly Incorporated Institution (formerly the British Association of Water-Works Engineers) was held last Friday and Saturday, at the apartments of the Geological Society, Burlington House, W. The PRESIDENT (Mr. E. Sandeman, M.Inst.C.E., Engineer to the Derwent Valley Water Board) was in the chair. There was a good attendance of members.

At the beginning of the proceedings, Mr. A. R. Crawley and Mr. A. Towler were appointed Scrutineers of the balloting-papers for the Council and associate members.

REPORT OF THE WATER AREAS AND STATISTICS COMMITTEE—LEGISLATIVE NEEDS.

The Committee on Water Areas and Statistics (Mr. Easton Devonshire, Chairman, and Messrs. W. Matthews, C. Clemesha Smith, H. Ashton Hill, Robert Askwith, R. H. Wyrill, J. S. Pickering, F. J. Bancroft, W. H. Humphreys, William Whitaker, and J. C. Thresh, with Mr. Percy Griffith as Secretary) presented a further report. Before dealing with the future, they thought it would be of interest to review what had taken place since the adoption by the members of the report of the Committee (at that time called the "Water Boards Committee") on Dec. 8, 1900. That report dealt with the question of amending the existing system upon which water-works undertakings in this country are initiated, authorized, carried out, and maintained, under the following headings: (1) The present system of control over undertakings for public water supply is unsatisfactory. (2) Existing powers for enforcing a proper water supply are inadequate. (3) The areas allotted to existing local authorities are altogether independent of the sources of water supply, and the trouble and expense of forming "United Districts" and "Joint Water Boards" are unnecessarily great. (4) The law relating to underground water is inequitable, and a constant danger to many public water supplies. (5) The law relating to the pollution of water requires revision. (6) The provisions for preventing waste are insufficient. (7) The collection and publication of official returns relating to existing undertakings are much to be desired.

The matters included in headings Nos. 6 and 7 have been since dealt with to a limited extent as regards the former, by the incorporation in recent Private Acts of Parliament of Model Clauses relating to the prevention of waste, &c., of water; and as regards the latter, by the preliminary inquiry made by the Local Government Board, under the order of the House of Commons, dated Nov. 24, 1910.

The questions dealt with by the Association under the above headings were brought before Mr. Walter Long, M.P., then President of the Local Government Board, in October, 1902, when the Association joined in a deputation for the purpose of calling attention to the question of protecting the sources of water supply, and to the pressing necessity for an inquiry into the state of the law on the subject. As a result of this deputation, the question was referred to the Royal Commission on Sewage Disposal, who, in their fifth report (which primarily dealt with the question of river pollution as affecting surface waters), recommended that: "Ultimate control should be vested in an adequately equipped Central Administrative Authority, and that, as far as practicable, the Local Rivers Boards should, in accordance with regulations framed by the Central Department, act as a first tribunal. Among the more important questions which have to be dealt with under the new conditions of administration which we are contemplating, are: (3) The protection of water supplies from pollution. (4) The collection of information as to the water supplies available in various parts of the country. (5) The collection of information as to the need of water in various parts of the country." No action was taken by the Government on these recommendations.

The report of the Joint Committee on the Water Supplies Protection Bill, 1910, called attention to the fact that the report of the Royal Commission on Sewage Disposal above referred to, as well as other reports which had preceded it, had asserted the same principle—viz.: "There is urgent need for a survey, at once comprehensive and in detail, of the water supplies and the water needs of the country, and for the adoption of measures for conserving the supply and disposing of it to the best advantage."

The Joint Committee expressed their agreement with the above opinion, and strongly recommended: "(1) The establishment (within the Local Government Board, or independently, as may seem best to the Government) of such a Central Administrative Authority as is contemplated in the fifth report of the Royal Commission on Sewage Disposal [quoted above]. (2) The division of the country into watershed areas, and the appointment for these areas of Local Representative Boards, who, subject to the guidance and control of the Central Authority, should prosecute systematic and continued inquiries into the water supply of their jurisdiction, taking all necessary measures to husband such supplies, both surface and subsoil, secure their preservation from pollution, and advise on their allocation for sanitary, industrial, and other purposes."

Following closely on the report of the Joint Committee, the House of Commons, on Nov. 24, 1910, ordered a return to be made "showing, as regards every water undertaking in England and Wales: (*a*) The powers, if any, under which undertakers are

authorized to supply water. (*b*) The limits within which undertakers are authorized to supply water. (*c*) The places actually supplied. (*d*) The sources of supply, their nature and sufficiency. (*e*) Particulars as to the works, quantity, and quality of the water supplied. And also as regards every district in England and Wales: (*a*) Area and population of the district, and number of houses therein. (*b*) Number of houses supplied with water from a piped service. (*c*) Names of the undertakers providing a supply of water. (*d*) Source, nature, and sufficiency of the supply where there is no piped service."

Having reviewed the steps already taken towards the solution of the problem, the Committee submitted suggestions [extracts only are given here] as to the lines upon which legislation, which appears to be imminent, should be carried out.

Organization of Central and Local Control.—As regards the recommendations of the Joint Committee on the Water Supplies Protection Bill, it is doubtful whether the Joint Committee intended to endorse the suggestion of the Royal Commission that *all* water questions should be dealt with by the same Central Authority and Local Representative Boards, who would be responsible for the protection of watersheds and river basins from pollution. We are, however, fully agreed as to the necessity for the creation of a Central Authority to deal with questions of water supply; and we further consider that the Local Government Board are well qualified to discharge the functions of the Central Water Authority, and that such authority should be constituted within the Local Government Board.

As regards the formation of Local Representative Boards on the lines suggested in the reports quoted, the Committee would point out that the hydrographical areas which would be appropriate to bodies controlling the national water resources, including, as they do, underground as well as surface supplies, are by no means coterminous with the geographical areas or river basins which might be allotted to the proposed Local Representative Boards. We are of the opinion that the body appointed to advise as to the future allocation of water resources and the abstraction of water, should be entirely independent of authorities who would be primarily interested in their own local supplies.

As the information relative to the national water resources would be of a highly technical nature, it is our opinion that the collection and collation of the returns should be placed in the hands of experts; and our suggestion is that the Central Authority should have associated with it the best expert advice obtainable on matters of engineering, geology, chemistry, and bacteriology, and should appoint expert officials in these and other sciences relating to water supply in each of the water areas into which the country might be divided. To secure the effective co-operation of the various experts, we suggest that they should be grouped into local committees, and that their principal duties should be the making of periodical reports to the Central Authority, and the collation of statistical and other information as to rainfall, flow of streams, levels of underground water, &c.

The procedure under the above scheme would be somewhat on the following lines: The expert local committees would first proceed to collate the existing information and statistics relative to the areas allotted to them, and would make a preliminary report thereon to the Central Authority, so that information already available might be promptly made use of. Subsequently the system of regularly collecting and verifying data on the lines above indicated would be initiated and established on a practical basis. In our opinion, it is most important that the substance of the reports made to the Central Authority should be published annually in a form convenient for reference, having in view, firstly, the affording of information to authorities or persons seeking for water supplies within various areas; and, secondly, the guidance of the Central Authority in advising Parliament on any schemes that might be promoted involving the allocation of water resources and the abstraction of water.

We are strongly of opinion that, for the present at all events, the existing procedure for obtaining powers to abstract water from any source should be continued, although we should welcome any practical means of reducing its costliness. While no doubt Private Bills would be necessary in dealing with large undertakings, procedure by Provisional Order of the Local Government Board might be made more general for smaller schemes. But in all cases Parliament would remain the final tribunal; and the Central Authority should act as an adviser to Parliament as to the effect of any scheme on local or national interests. To provide the necessary interval for the Central Authority to prepare its report on any scheme would doubtless involve the earlier deposit of plans for proposed works; but we consider that this would not involve any appreciable inconvenience.

Statistics as to Water Supplies, &c.—As regards the collection of statistics, the Local Government Board, in carrying out the order of the House of Commons, made in November, 1910, have issued forms for the purpose of obtaining the information called for by the order quoted in the earlier part of this report. The Committee, however, submit that the statistics and other information obtained from this preliminary inquiry, although valuable so far as they go, will be inadequate either as an indication of the national water resources or of the extent of their present use, particularly as the order makes no reference to private and non-statutory supplies, which, it is believed, represent in many districts a total volume of water equal to, if not in excess of, that abstracted by public and statutory undertakings.

State Control of Sources of Water Supply.—We have already referred to the absence of any attempt to collect information with regard to the abstraction of water by private persons and non-statutory companies or users. It will be sufficiently obvious that no scheme for the effective conservation and control of the national water resources can be devised until, firstly, information is available as to the extent to which water is abstracted in this way at the present time; and, secondly, until the whole of such supplies are brought under State control. The most evident circumstances under which this control is required are those where water is pumped to waste for the drainage of mines, quarries, or similar works, and where sources, especially those underground, are drawn upon for industrial uses to such an extent as to directly affect sources of public supply, or to deplete the general supply of the neighbourhood. At the present time, Parliament not infrequently imposes conditions on statutory water undertakings, either as regards the position in which wells may be sunk, the quantity of water which may be abstracted, and the compensation to be paid in case any private works in the neighbourhood are depleted by the works authorized; and in recent years these restrictions have been considerably extended. We are strongly of opinion, and we think it cannot be denied, that similar restrictions as to the abstraction of water from various sources should be imposed upon private companies or persons; and the only possible manner of imposing such restrictions appears to be in requiring that, except in cases where water is taken by the owners or occupiers of property for their own domestic use, or, in the case of estates, for agricultural purposes, all companies, bodies, or persons abstracting water from either surface or underground sources should obtain official sanction from the Central Water Authority—such sanction to be confirmed by Parliament or not, according to the relative importance of the supplies abstracted, but in any event subject to public notice being given of the intention to abstract such water, and the holding of a local inquiry, such as is now involved in procedure by Provisional Order, &c. In the case of smaller supplies, the sanction might well be in the form of a licence of the Central Water Authority, such as is now granted by the Board of Trade in regard to constructing more or less unimportant foreshore works on tidal rivers and estuaries.

The case of railway companies, who are in a position to abstract water at any point on their systems and to convey it on their own property to a distance, has been dealt with by Parliament in the Sutton District Water Act, 1906;* and the principle therein enunciated should, in our view, be embodied in the general water-works law.

It will be seen that any General Act giving legislative effect to the above proposals would go far to remedy the present anomalous condition of the law of underground water.

Scope of Water Legislation Required.—The most important function of any revision of the general water-works law would be the consolidation of the very numerous Acts and clauses which now affect questions of water supply, with a view to avoiding the present necessity for "legislation by reference." The Committee are of opinion that a new General Act is required, which might appropriately be termed "The Water-Works Clauses (Consolidation) Act." A Statute of this nature would re-enact clauses of common application contained in the General Acts.

The new Act should also embody such clauses of the Model Water Bill as are of general application. These clauses are now generally inserted in Private Water Bills, and may be taken as standardizing the modern requirements of the Legislature. It is therefore clear that, as far as possible, their provisions should be made of uniform and general application, subject only to the reservation of such existing exceptions as might reasonably be held to depend on special local conditions.

Beyond the point already mentioned, we suggest that the new General Act should deal with the following, among other matters: (1) The right of local authorities to purchase water rights under Provisional Order of the Local Government Board. A Bill for this purpose has been introduced in the present session by Mr. Herbert Lewis, Parliamentary Secretary to the Local Government Board. (2) Power to be conferred on water authorities to repair consumers' service-pipes at the expense of the consumer. (3) The reservation to the water authority of the right to open roads, &c., for the purpose of laying and repairing service-pipes at the expense of the consumer. (4) An extension of the provisions of section 35 of the Water-Works Clauses Act, 1847, and of the Public Health Act, 1875 (section 51 *et seq.* and section 229 *et seq.*), so as to specifically empower local sanitary authorities to guarantee, either singly or in combination, the interest on the cost of mains to be laid by existing water authorities. (5) Declaring it to be unlawful for any company, body, or person, except with the express authority of Parliament, to convey by pipe or conduit for sale or use beyond the area of supply water abstracted within that area. There are other points in connection with water supply under modern conditions which could be suitably

* Sutton District Water Act, 1906 (Clause 3): "From and after the passing of this Act, it shall not be lawful for any company, body, or person, except with the express authority of Parliament, hereafter obtained, to convey by pipe or conduit for sale or use beyond the area of supply water taken from any well or watercourse within such area. Provided that nothing in this section contained shall take away: (1) Any right of any landowner (other than a railway company) to supply with water any part of his estate situate within, or partly within and partly without, the area of supply, or to construct works for that purpose; or (2) Any right of any railway company to supply with water any station or stations within the area of supply or to construct works for that purpose or to use on any engine or carriage without as well as within such area water supplied at any such station or stations."

dealt with in the new Water Act, such as the question of supplying water *in transitu*, on which evidence was given by our President and others before the Joint Committee on the Water Supplies Protection Bill.

There is also the important question of bye-laws for the prevention of waste, contamination, &c., of water supplies. The clauses contained in the Model Water Bill authorize the adoption of bye-laws sanctioned by the Local Government Board, who have recently published a new code of model bye-laws. These, while they do not fully endorse the right of water authorities to make specifications as regards fittings, are still of very great value, and might advantageously be adopted by water authorities in general. In this connection, the position of water authorities operating either under the Public Health Act, 1875, or under Private Acts incorporating the Water-Works Clauses Acts alone, is deserving of attention, as at the present time such authorities are unable to adopt bye-laws with respect to water supply. Legislation for the purpose of removing these disabilities is urgently needed; and we suggest that, pending the preparation of a new Water Act, a short Act should be passed granting powers to make bye-laws to all water authorities who at present have no such powers.

In view of the many points to be dealt with in consolidating Water Legislation, we consider it essential that any Bill introduced for this purpose should be referred to a Joint Committee of both Houses, with power to call for evidence on behalf of all the interests affected.

Discussion.

The Secretary (Mr. Percy Griffith) having read the report,

The President said he agreed with the report in almost every particular. In one respect, it might be amplified. If the collection of statistics were placed in the hands of certain local experts, they would, he presumed, be engineers and others who might be in business themselves. They would not be entirely Government servants. It was possible, and he thought exceedingly probable, that this arrangement would be for a time a very good one, and that it would yield excellent results; for this reason, local experts would deal with districts in which they had special knowledge, and they would give the State Department special information. But he thought eventually it would be necessary that these experts should become servants of the State Department. In whatever capacity they acted, however, he considered it was essential their methods of obtaining information should be on the same lines. It might be extremely awkward if different methods were adopted by these experts; otherwise, for instance in gauging streams, results would be obtained that would not be equally correct. Therefore he thought that the State Department should define the principles upon which they should work. As the basis of water supply was rainfall, it seemed to him almost a necessity that the first step a State Department should adopt should be to take over the existing rainfall organization, which was at present a private one, and maintained by subscriptions. This organization was worked extremely well by private persons; but he considered its transfer should be made a *sine quâ non*.

Mr. Easton Devonshire (London) said the report was the outcome of many years' work of the Committee. On this occasion their report was not simply one criticizing work that had been done; but the Committee thought they would do well and wisely to put forward constructive proposals as coming from the Institution. The Committee had the last two years been following very closely particularly the evidence given in opposition to Lord Desborough's Bill. Most of the members of the Committee attended with great regularity the ten or dozen meetings of the Joint Committee who had the Bill under consideration; and the impression left by the evidence on their minds was that there was a strong consensus of opinion as to what should be done. But on some points, there was a certain vagueness, especially on the one as to local representation boards, and how they were to deal with the control and collection and collation of statistics in the areas into which the country might be divided. This was the only point on which they had ventured to express an opinion that differed from the broad lines laid down in the report on Lord Desborough's Bill. On the subject referred to by the President, he might say, after mature consideration, the Committee came to the conclusion that the idea of appointing local representation boards from bodies which had to do with the distribution of water, and who were therefore interested more in what they could get for themselves than in the interests of the community at large, was a mistake, but that it would be necessary, although perhaps going a bit on the socialistic idea, for it to be State controlled—not only that the central authority should be in the hands of a State Department with its own experts, but that those who did the local work should be servants of the State, and report to the central authority. They should be entirely independent of the interests of those who were particularly concerned locally with the acquisition and distribution of the water. He concluded by moving that the report be received and adopted, and that the Council be authorized to take all possible steps towards accomplishing the suggestions that were contained in it.

Mr. William Matthews (London) seconded the motion. He remarked that he was one of those who was not without hope that some really substantial good might come out of the work. It was undoubtedly true that the officials of the Local Government Board were waking up to the fact that something must be done; and this he thought was proved by the short Bill to remedy one of the difficulties pointed out particularly before Lord Desborough's Committee that was introduced in the present session. It had had to "go" with other "innocents." But one hoped it might be re-introduced next year. Perhaps it was not altogether ill that the Bill had fallen through this session, because it was quite possible the Institution Committee might go to the Local Government Board, and, when Mr. Herbert Lewis re-introduced his Bill next session, he might possibly be persuaded to tack a little more on to it, and so get some of the things for which they were now asking. Mr. Burns had also proposed in the present session to introduce a Bill; but they had not heard anything more of it. At the present juncture, however, there were indications that it was quite worth while the Institution dealing with this matter in a serious spirit. Lest there should be any misconception as to what was the proposal of the Committee with regard to control, he might say that it had been whispered to him that State control might be twisted into State acquisition. He did not think, if anyone read the report thoroughly, and took it altogether, with the context, that any suggestion of State acquisition could arise out of the report. What it really meant was State aid in getting information, and State control, but not State direction.

Mr. W. Jones (Pontypridd), referring to suggestions made by the Committee, asked why mains were not included as well as service-pipes. Some of them with experience as managers of private water companies had considerable difficulty with local authorities in regard to the opening of roads for laying mains. He took it they were asking for power to open roads without the consent of the local authorities.

The President: This is a power to repair consumers' service-pipes.

Mr. Devonshire remarked that, so far as he was aware, all authorities had power to lay mains in public roads, and all consumers had power to lay connections with these mains in the public roads. But under the General Act, the consumer had no power to break up a road to repair his own property. If it came to a question of repair, the consumer sheltered himself behind this fact; and it remained for the water authority to open the road to repair the main to stop the leakage.

Mr. F. J. Bancroft (Barnet): Or cut him off.

Mr. Devonshire added that what was wanted as to the past was the power to break open the road, repair the consumer's service-pipe, and charge him with it; and as to the future, that the right to break up roads and lay mains or service-pipes should be exclusively reserved to the water authority, so that no consumer should lay a service-pipe. The work should be done throughout by the water authority at the expense of the consumer.

Mr. C. Sainty (Windsor) thought there was a mistake there. It ought to be the owner of the property, not the consumer, because there were many consumers who could not afford to pay for the repair of the pipes. They often found that a tenant of property had it on a lease, which required him to repair it inside, but not outside.

Mr. Devonshire: It has been decided that the person who uses the water is responsible for the prevention of its waste.

Mr. A. B. E. Blackburn (Sunderland and South Shields Water Company) said he was glad to hear Mr. Matthews say what he did with reference to not taking the direction out of the hands of those who now looked after the water supplies of the country, because it was most important that the authorities whom the members of the Institution represented should not have an idea that they were trying to get the Government to take the local control from the statutory bodies already possessing it. What was the position at the present time? Parliament in Water Bills during the last few years had been restricting the abstraction of water by water authorities, and providing compensation for those injuriously affected by their operations. But these more recent enactments were not general in their application. Any persons or industrial undertakings—such as collieries, railway companies, breweries, &c.—who might be, and were in many parts of the country, abstracting large quantities of water, were not in any way touched by them, but remained under the general law. Principles of equity demanded that one class of water-abstractor should not be penalized to the advantage of another class; and yet this was precisely what would have happened under the provisions of the Water Supplies Protection Bill, 1910. The principle of compensation for any damage by those proved to have done the damage should apply equally to all who, in any way, interfered with the natural flow of either surface or underground water supplies. The present tendency to add to the burdens and restrictions of those water authorities who supplied large populations with a prime necessity of life while leaving undisturbed and unrestricted commercial and private interests, could not continue indefinitely; and some steps ought undoubtedly to be taken to put matters on an all-round equitable basis. It was urged before the Select Committee on the Water Supplies Protection Bill, by him and other members of the Institution, that, before any general revision of the water-works law was made, there should be a comprehensive inquiry into the whole question of the national water supply; and the necessity for a central authority was strongly put forward. With regard to the organization of the central authority, he would advocate the appointment of a permanent body of Water Commissioners under the President of the Local Government Board, or a responsible Minister. The Commissioners should include at least two water engineers having a knowledge of geology and practical experience in surface and underground water supply, and a chemist and bacteriologist. They should be empowered to hold inquiries, call witnesses,

appoint local experts and inspectors to assist them, and require the compulsory collection and return of statistics of rainfall, water-levels, water pumped, water consumption, &c., not only from water authorities, but also from all parties who abstracted either surface or underground water. It would also be the work of the Water Commissioners to arrange for, and carry out, the survey of the water needs and supplies of the country, which would enable them to advise Parliament. It was, he thought, common knowledge that a very large percentage of water authorities had been short of water during the past dry summer; and when water authorities were liable to pay for the extra cost of excessive sickness caused by shortage of water supply under the Insurance Bill, there would no doubt be an increased demand for fresh sources of water supply, especially by small water authorities. It became more imperative therefore that, without further delay, this matter of a water commission or central board should be taken in hand. It was of great importance that the cost of obtaining powers for fresh water supplies should be made as low as possible; and some scheme with this object in view should be considered by the Commissioners at the very outset of their investigations.

Mr. T. Reader Smith (Kettering) said it seemed to him they were suggesting rather large powers if they asked the local sanitary authority to pay interest on their mains. They had under the Water Acts power to obtain a 10 per cent. guarantee for three years. Was it suggested that this paying of interest should be compulsory or a matter of agreement with the local authority, because a company might lay extensive mains if they had the option of calling upon the local authority to pay interest.

The President said it was not compulsory at all. They only proposed that power should be taken. Whether they wanted to exercise the power or not, at present they had no power.

Mr. Devonshire observed, in reference to Mr. Blackburn's remarks, that perhaps the Committee in their report had unintentionally minimized the importance they attached to the central authority. As to Mr. Smith's remarks, sanitary authorities had power under Acts of Parliament, in cases of district supply by a water company, if the company did not supply water in accordance with their obligations, to find their own supply.

Mr. H. Ashton Hill (South Staffordshire Water Company) said, with regard to the laying on of supplies to properties, villages, and so on within the parliamentary area of a water authority or company, this was a regular experience in his own case. What they had done was this. They said to the local authority: "It will cost us so much to pipe a district, but the houses which exist are not sufficient, even if they all took water, to pay 10 per cent. on the capital outlay." Then came a point in the reading of the Act which dealt with this. Many people thought that, if a local authority guaranteed 10 per cent. on the capital outlay, this fulfilled the requirements of the Act. He did not read it that way; and he did not think it was the proper reading. He thought that the water authority or company were not bound to supply under the Act unless there were houses existing at the time which were willing to take a supply of water, and the revenue from which would be equal to 10 per cent. on the capital outlay. Therefore, if there were not houses enough, the local authority could not claim a supply under the Act. Then it became a question of agreement. The Company could say: "We will go to this outlay, provided the local authority will guarantee 10 per cent." In other words, the local authority had to agree to make up the balance until such time as property was built that would pay 10 per cent. But some local authorities thought they ought to take the good with the bad.

Mr. Devonshire said he thoroughly understood the principle of the 10 per cent. on the three years' basis. If there were a sufficient number of houses in the district the rentals of which would produce 10 per cent., the water company must lay mains if requested to do so.

The resolution was unanimously carried.

Papers and Discussions.

The papers were arranged to be read and discussed in the following order:

(1) "Portland Cement on Public Works." By Mr. Gerald T. Edwards.
(2) "Water-Works Management." By Messrs. Easton Devonshire and William Matthews.
(3) "New Water-Works for Skegness." By Mr. Percy Griffith.

Abstracts of the papers and of the discussions will be published in succeeding issues of the "Journal." Owing to want of time, Mr. Griffith's paper was taken as read, and the discussion postponed to the summer meeting.

A Transfer.

Mr. John C. Hawkins (Paignton) was transferred from the class of associate-members to that of members.

Election of Office-Bearers.

The Scrutineers of the ballot papers reported the following elections:

President: Mr. Joseph Spiers Pickering, of Cheltenham.
Vice-Presidents: Mr. C. Clemesha Smith, of Wakefield, and Mr. Thomas Molyneux, of Stockport.
Ordinary Members of Council: Mr. A. B. E. Blackburn, of Sunderland; Mr. Easton Devonshire, of London; Mr. Frederick Griffith, of Leicester; Mr. William Matthews, of Westminster; Mr. F. W. M'Cullough, of Belfast; Mr. C. H. Priestley, of Cardiff; Mr. Harold W. Woodall, of Bournemouth; Mr. F. J. Bancroft, of Barnet; Mr. Henry Preston, of Grantham; Mr. S. C. Chapman, of Torquay.

[The last four are the new members of Council.]

New Associate-Members.

The following associate-members were elected: Mr. H. A. Braddock, of Stockport; Mr. C. Clegg, of the Leighton Reservoir, Masham, Yorks; Mr. H. L. Groves, of Chingford, Essex; Mr. F. Langley, of Buxton; and Mr. H. Sidenius, of Bassano, Alta, Canada.

Summer Meeting at Cheltenham.

The President-Elect (Mr. Pickering) desired to thank the members for electing him as President—an honour which he highly appreciated. He felt great difficulty in following in this position so many eminent members of the Institution—members who had filled the office with such dignity, grace, and great ability. He, however, could assure the members that nothing would be wanting on his part to make his presidential year a successful one. He had the authority of the Mayor of Cheltenham (who happened to be also the Chairman of the Water Committee) to invite the Institution to hold their summer meeting at Cheltenham. It was suggested by the Council that it should take place about the second week in June next; and he hoped this would be a suitable time for the members generally. He was sure the Corporation and the town would do all they could to make the members of the Institution welcome.

The announcement of the invitation was very heartily received by the members.

Attendance of Chairmen and Vice-Chairmen.

Alderman H. Bevor, J.P. (Birkenhead), said that he had for many years, as Chairman of the Water Committee of the Birkenhead Corporation, attended the meetings of the Institution; and he thought if the Institution had not formally invited Chairmen and Vice-Chairmen of Corporation Water Committees to be present, it would be a proper thing for them to do. Personally, he had derived great benefit from his attendance at the meetings through the interesting and instructive discussions that had taken place.

The President remarked that they were only too glad to see Alderman Bevor present, as well as other Chairmen or Vice-Chairmen of Water Committees or Companies. A question the Council were likely to have before them shortly was as to whether direct invitations should be issued to them.

Votes of Thanks.

Hearty votes of thanks were next passed to the President and Council of the Geological Society for the use of their rooms, to the Scrutineers, and to the authors of the papers.

Development of the Trinidad Oilfields.

It will be seen, from an announcement appearing elsewhere, that the Trinidad Oilfields, Limited, are inviting applications for an issue of £150,000 of participating debenture stock, at £95 per £100. It will bear interest at the rate of 6 per cent. per annum, and be entitled, in addition, to 20 per cent. of the net profits in each year. The Company was incorporated early last year to acquire oil and mineral rights in and over lands in the Guapo and La Brea districts in the Island of Trinidad; and they control a territory aggregating approximately 7800 acres. The Company possess a fully equipped and organized field; and work is proceeding night and day on six wells, three of which are producing large quantities of oil. A well was brought in on the 8th ult., and its estimated yield was more than 3500 tons of oil in 3½ hours, which is believed to be a world's record. The latest report as to this well shows that the drill penetrated the oil sand at 8.30 p.m., and by 10 p.m. it was giving a steady stream of oil; an earthen tank, of 1800 barrels capacity, being filled in about ten minutes. The oil continued to flow until 1.15 a.m.; but only about one-fourth of the production could be saved. The enormous yield of this well is considered by the Company's Consulting Engineers (Messrs. Thompson and Hunter) to confirm their repeatedly expressed opinion in regard to the great value of the property. The objects of the present debenture issue are to provide for the erection of a large refinery, further develop the Company's original properties, organize marketing arrangements, and make provision for increased storage and transport. The Company's share capital is £300,000, of which £260,000 has been paid up. The Chairman is Mr. Corbet Woodall, who is also one of the Trustees for the holders of the debenture stock. The subscription list opened yesterday, and will close to-morrow.

Mr. John F. Simmance, the Managing-Director of Alexander Wright and Co., Limited, asks us to state that, owing to continued expansion of the business, it has been necessary to utilize extra managerial assistance; and Mr. James Foreman has been appointed to the position of General Manager. Mr. Foreman is well known to many gas engineers throughout the country—having been connected with the firm since 1887. For years he has acted in the capacity of chief photometrical assistant.

THE CARBONIZATION OF COAL.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[The Second of a Series of Four Cantor Lectures delivered before the Royal Society of Arts, Dec. 4.]

In the destructive distillation of coal, both for gas and coke production, the coals dealt with are bituminous in their character, and are comprised in classes 2, 3, and 4 of Gruner's classification—that is, they all contain enough resin constituents to yield a gas of good illuminating value and a high percentage of hard coke. But the quality and quantity of both gas and coke will depend upon the conditions under which the distillation is carried out; and these have been gradually evolved during a century of practical experience to the point which gives the results attainable at the present time. Before discussing the process of carbonization from the scientific side of the question, it will be well to review the changes which have taken place in the methods employed, as, although they have been based largely on economic considerations, they show also the conditions which influence the yield, composition, and characteristics of the various products.

The Early History of Coal-Gas Making.

When Murdoch first made coal gas at Redruth, the retort which he employed was simply a cylindrical iron pot, set over an open fire in the same way as a scullery copper. It held a charge of 15 lbs. of coal, was closed at the top by an iron lid, and the gas was led off 3 or 4 inches below the lid by a horizontal iron pipe. The trouble, however, of removing the coke after the carbonization of the charge was so manifest and serious a drawback that, as early as 1802, he had adopted a horizontal cylindrical vessel, from which the charge could more easily be raked out; while the flue was so constructed that the flame surrounded the retort and then made its escape direct into the chimney. He seems to have tried several settings of this character, with retorts varying in size from 12 to 20 inches in diameter, and from 3 to 7 feet in length.

At this period also Murdoch seems to have tried a cylindrical retort placed at an angle of about 45°, with a mouthpiece at each end to aid in charging and discharging. None of these earlier forms of retort were of any great size; the usual charge he employed being about 15 lbs. But soon after he reverted to the pot form; and in order to facilitate the discharging of the coal, he fitted into it an iron cage, which was put in before the coal charge, and which could be lifted out bodily by means of a small crane. In this he carbonized 15 cwt. of coal at a time; and in the experiment came upon a trouble which is common to every process of carbonization in bulk—that is, that the process of carbonization proceeds rapidly at first, producing a layer of coke next to the heated surface. This being a bad conductor of heat retards the process of carbonization, owing to the slowness with which the heat is transmitted to the inner portion of the charge; while the gas evolved in the interior portion, having to pass through the heated coke, loses a large proportion of its illuminating power in consequence of the breaking-down of the rich hydrocarbons, with liberation of oxygen.

Before 1810, Murdoch had also discovered that, in order to get the best gas yield, a high temperature was necessary, and that if carbonized at too low a temperature the volume of tar produced was greatly increased in quantity, and the yield of gas reduced in a corresponding ratio. He also made a certain amount of progress in the setting of the retorts in the furnace by making flues around the horizontal retorts which would ensure as much as possible of the heat being utilized.

At this period the evils arising from submitting the gas to too long a travel through the incandescent coke seem to have been generally realized by other observers, and attempts began to be made to carbonize the coal in thin layers, so that the gas should escape more freely and would not have to pass over any very great surface of heated carbonized material. A retort was patented by Clegg in 1815, which he termed a rotary retort. This consisted of shallow boxes attached to radial arms rotating on a central shaft. The coal was charged in at the cool side of the shallow circular retort into the trays; and in this place also the tray of coke could be removed. Carbonization took place on the heated side of the retort, into which the radial arms carried the tray containing the new charge. Although several installations were erected, as might be expected, they proved a failure—a fate which also befell his web retort, in which an endless chain carried the coal to be carbonized in a thin layer through the carbonization chamber.

The advantages of a thin stratum of coal, however, having been fully recognized, Malam introduced wide oval retorts, set in a horizontal position, the bottom only of which was charged with the coal; and he further made an advance in the setting by placing five and six retorts in a bench heated by three fires. By 1841, the form of retort used seems to have settled down to an oval ⊃ shape or circular retort, five of which were placed horizontally in the same bed or setting; and these retorts, being rapidly deteriorated by direct contact with the fire, were protected by fire-clay shields or tiles.

The Passing of the Iron Retort.

In none of these early retorts, however, could any temperature beyond 800° C. be employed; otherwise the exterior became so acted upon that they had a life of only a few months, while with the greatest care their life was seldom more than eight or nine months. Even when working at lower temperatures than those usually employed, it is found that great trouble is caused by what is known as the "growing" of iron, which takes place unless the greatest possible care is taken in the selection of the metal. This phenomenon is caused by the hydrocarbon gases permeating the metal and becoming decomposed there, so leaving a deposit of carbon, which gradually forms a spongy mass; and it is not an unusual thing for a 10-feet retort to increase two or three inches in length after a few months' working.

This trouble with the metal retorts led to attempts being made to introduce fire-clay retorts; but these met with such opposition that it was not until nearly the middle of the century that they became generally adopted. Before fire-clay retorts had become general, however, brick ovens were used in many places. The early ones were square, and capable of containing about 4 to 5 cwt. of coal per charge; but later they were altered to a flattened ⊃ shape, and increased in size so as to be capable of receiving a charge of 10 to 12 cwt. of coal. In these, carbonization seems to have been very rapid, as five hours is given as the time taken to carbonize the charge; but the consumption of fuel was excessive, sometimes rising to 70 per cent. of the coke produced. This, however, was probably largely due to faulty construction of bad settings and furnace and general flue arrangements. Their life, however, was four or five years; and they produced coke of a very good quality.

The Advent of Through Retorts.

In the early fifties, fire-clay retorts almost entirely displaced these ovens; and they have ever since been adopted—their section being made much the same as with the old iron retorts. As can easily be imagined, the fifty years that saw the inception of the gas industry, also saw great advances in the retort-settings. These resulted in considerable fuel economy; so that by the early sixties the fuel consumption had settled down to about 20 per cent. of the coke produced. Up to this time, most of the retorts had been what is termed "single-ended"—that is, closed at one end—and had only one mouthpiece. In the larger works, however, double-ended retorts, with a mouthpiece at each extremity, soon began to displace these.

The advances which had been taking place, both in the material of the retorts and in the settings, had led to a general increase in the temperature of carbonization employed. But even in the days of iron retorts it was found that considerable trouble arose from a crust of dense carbon deposited on the inner surface of the crown of the retort, due to the effect of heat upon the escaping hydrocarbons; and when, with the introduction of fire-clay retorts, the temperatures were raised, this became a very serious trouble, as it led to the retort having to be scurfed at frequent intervals. If this was done mechanically, as it generally was, great damage to the retort resulted. A slight improvement took place with the discovery that the deposit could easily be burnt off by causing a flow of air over the surface of the retort when heated and empty, which burnt off the carbon, and that a mixed steam and air blast could be used with even greater advantage for this purpose. The trouble, however, was at one time so great that it appeared as if the limit of temperature had been reached. But the discovery of the fact that pressure had an enormous influence in causing the deposit led to the introduction of the exhauster, to suck the gas away from the retort. This gave the possibility of working with little or no pressure in the retort, and led to a great improvement in the amount of deposit formed, and also in the quality and quantity of the gas produced.

The Inclined Retort and Gaseous Firing.

About 1885, Coze introduced the idea of placing the retort just at the angle of slip of the coal, so as to utilize gravity to aid the charging and discharging. The former was done from a hopper through the mouthpiece at the upper end of the retort; while after the charge had been carbonized, the removal of a stop and the "tickling" of the charge caused it to slide out. This idea was gradually adopted, and the inclined retort has played a very important part in gas manufacture during the past twenty years; and by the application of gaseous firing and regenerative settings very high efficiency has been obtained from them.

The idea of regeneration, which was adopted for all forms of settings, enabled heats to be attained which before had been impossible; and this, coupled with gaseous firing, gave a control of temperature the importance of which cannot be over-rated.

Since 1893, when the advent of the incandescent mantle as a practical method of developing light began to do away with the necessity for gas of high illuminating value, so general became its adoption that in 1900 applications began to be made in Parliament in various Gas Bills to reduce the standard of light for those companies whose previous average had been about 16 candles—it being felt that a 14-candle gas was better fitted for yielding light with the incandescent mantle, power in the gas-engine, and for heating in gas-stoves, than higher qualities. It also gave the possibility of economies in manufacture, which it was hoped might lead to the lowering of the price of gas to a point at which it would better compete with fuel gas for power purposes.

The Coming of the Vertical Retort.

During the last ten years, there has been an amount of activity in attempts to alter the process of gas manufacture which has

exceeded any that has taken place since the first few years of its inception; and this new era may be considered to have started with the inauguration of the vertical retort, in which, by utilizing a large oval fire-clay retort set on end, with a slight taper from bottom to top, much larger charges could be used than had been possible with the horizontal or inclined retorts, and in which also gravity was utilized to the full for charging and discharging.

The vertical retort dates back to 1828, when it was first introduced by John Brunton, who, finding that the gas could not escape freely from the lower portions of the charge, and so created considerable pressure, put a perforated pipe in the centre of the charge to afford an easy way of escape. Nothing more was heard of the process; so I presume it failed. But at later dates attempts of the same kind were made by Lowe and Kirkham, and also by Alexander Scott.

After these early experiments, nothing seems to have been done for sixty years, until the summer of 1903, when Settle and Padfield put up a vertical retort at Exeter, and Dr. Bueb started experimenting on the subject in Germany. In Bueb's patent, which is dated July 7, 1902, he sets forth the trouble in the early forms of retort from the gas in the lower part of the charge having to traverse the column of incandescent coke above it, and proposes to overcome this by heating the retorts only on three sides, and having a series of nostrils on the cool side through which the gas could escape from all parts of the charge. The fallacy of such an arrangement must soon have become manifest, as by July, 1904, an experimental setting of ordinary verticals was at work at Mariendorf. In July, 1904, also, Woodall and Duckham brought out their first patent; and with the Settle and Padfield process still being experimented with, the new era of vertical carbonization was well started. Vertical retorts during the last few years have met with great success on the Continent; and their use has spread with the greatest rapidity.

In England, it has been felt that, good as are the results obtained with the vertical retort working intermittently—*i.e.*, by putting in a full charge of coal, carbonizing, and drawing, and then recharging in the same way as with the old form of retorts—great improvements could be effected by making the process continuous, as was first attempted by Settle, so approaching more nearly to uniform conditions of carbonization. Vertical retorts on this principle have been devised by Messrs. Woodall and Duckham, and by Messrs. Glover and West, and they certainly show results which will lead to continuous carbonization being one of the most important factors in the future of gas manufacture.

Heavy Charges and Increased Makes.

The economies to be derived from carbonization in bulk have on the Continent led to still further advances in the size of the charge, and little more than three years ago chamber carbonization was introduced at Munich, in which charges of 3 to 8 tons of coal can be dealt with at a time. This method also has met with much success; a number of installations having been erected on the principles laid down by Ries, Koppers, and others.

Many observers felt that the old horizontal retort could be made to yield better results than had hitherto been obtained, and Mr. Charles Carpenter, at the South Metropolitan Gas Company's works, found that great advantages could be obtained by packing the old horizontal retorts full of coal, as had been suggested by Kunath in 1885, instead of only partly filling them. This did away with the large space that had always been left above the charge of carbonizing coal, and so eliminated to a great extent the baking of the gases and contact with the heated crown of the retort, and gave a distinct advance in make and quality, not only in the gas but in the tar.

At Norwich, Mr. Thomas Glover has installed a form of retort which is a compromise between chamber carbonization and a full charge in the horizontal retort, and which has been giving a marked advance in the products obtained by the carbonization.

As already pointed out, while these changes in form have been taking place, improvements in the settings, gaseous fuel, and regenerative firing have made such strides that the temperatures employed are limited only by the nature of the refractory material used. The result of full charges with higher temperatures is to largely increase the volume of the gas obtained per ton of coal; but at the same time its illuminating value is reduced, and the tar is deteriorated. It also gives rise to stoppage of ascension pipes, and increase in naphthalene troubles in the service.

When iron retorts were used, the heats that could be employed were limited by the softening point of the iron, and rarely rose above 800° C.; and although only 9000 cubic feet of gas were made per ton of coal, the gas was rich in heating and lighting value, and the tar excellent in quality. The advent of the fire-clay retort, as has been seen, enabled temperatures to be increased, and 10,000 cubic feet of gas was the general yield. With the introduction of regenerative firing, the volume of gas obtained rose to 11,000 cubic feet; while the more modern developments approach a yield of 13,000 cubic feet.

In all these changes the gas manager has been actuated by the desire to get the greatest volume of gas possible per ton of coal, and at the same time to do it with the greatest economy; and but little attention has been paid to the quality of the tar and coke, which have been looked upon as bye-products. In point of fact, the tar, when heats were pressed to their highest degree in lightly charged horizontal retorts, became so poor and choked with naphthalene and free carbon as to be almost valueless. The introduction of large masses of coal in carbonization, for reasons which will be discussed fully later, has led to distinct improvements in this respect; and although there is no modern tar which approaches in value the product of the old iron retort, the improvement in many places has of late been most marked.

The Conversion of Coal into Coke.

The idea of converting coal into coke first arose from the desire to supplement charcoal for metallurgical work by some other form of fuel which would have much the same characteristics; this being necessitated by the fact that the timber on which the charcoal supply was dependent was rapidly becoming depleted. The characteristics most desired were local intensity on combustion, strength of structure, smokeless burning and infusibility, together with as small a proportion of sulphur as possible; and the only raw coal which could have been employed to at all fulfil these requirements was anthracite, which has always been comparatively high in price and difficult to deal with in practice.

The bituminous coals, which were the ones generally available, could not, for instance, have been used in the blast-furnace, on account of their swelling, softening, and forming arches, which would have interfered with the descent of the charge in the furnace and passage of the hot gases; while the intensity of the heat would have been low, owing to the amount withdrawn by the gases and vapours and rendered latent in distilling off these volatile products, and also because of the oxygen present in the coal. When, however, bituminous coal is converted into coke, the residue is infusible, its friability is decreased, and with the concentration of the carbon, though the total increase in calorific value appears small (no heat being withdrawn by the distillation), the local temperature is very largely augmented.

With the increase in coal mining which took place in the first half of the last century, another important reason for the coking of coal presented itself. In all collieries raising bituminous coal the percentage of slack and small coal was high; and where any of the coal is of younger formation, the smalls will sometimes amount to 40 or 50 per cent. As before the introduction of automatic stoking machinery the demand for this was very limited, all the screenings and smalls of a colliery had to be sold at a low and unremunerative rate. With a comparatively small amount of labour, however, these screenings could be converted, in the old coke meilers and beehive ovens, into larger masses of hard coke exactly suited for metallurgical and furnace work.

Another reason, which was not at first recognized, but which has now assumed great importance, is that the sulphur present as pyrites and other sulphur compounds in all coal can be substantially reduced at a very low cost in properly-made coke. This being due to the fact that the larger pieces of pyrites having been hand-picked, a considerable proportion of the impurities, including residual pyrites, can be got rid of by crushing the coal and washing it, when, being heavier than the coal, it can to a great extent be separated by gravity in the trough and jigger washers. On coking the washed coal, the heat expels a considerable proportion of the remaining sulphur, which comes off with the gases as sulphuretted hydrogen, carbon disulphide, and other organic compounds of sulphur; while quenching the red-hot coke on its removal from the oven eliminates another small percentage. So that a very substantial decrease in this deleterious constituent of coke for metallurgical work can be obtained.

With the introduction and general adoption of coal gas in the early years of the last century, coke was yielded as a bye-product of the destructive distillation; but gas manufacturers, looking on it as a bye-product, have from that day down to the past few years paid little or no attention to modifying the process of gas manufacture with a view to improving the quality of the coke produced, with the result that gas coke has always been looked upon as an inferior product, and the market which it commanded has been of a limited character. It has never achieved much success as a domestic fuel, and its chief output has been due to its use by small manufacturers, for horticultural work, heat production in gas-works, and the generation of water gas and producer gas. Coke may be divided into two main classes—

1.—Metallurgical and furnace coke, made by processes in which everything has been done to obtain the largest yield of coke, having definite characteristics, and in which the bye-products, gas and tar, are either disregarded or considered of secondary importance.

2.—Gas coke, made by processes designed to give the largest yield of gas, in which as much of the carbon as possible shall be in gaseous combination; the coke residue and tar being looked upon as of secondary importance.

Metallurgical and Gas-Works Coke.

In making the first class of cokes, the factors which are desired in the process are—using coal only rich enough in resinic volatile matter to give the necessary coking or binding properties to the mass, to crush the coal to uniform size, to use large charges, densely packed, and to carbonize for long periods, raising the outer crust of the coke first formed to as high a temperature as possible, so that, as the heat penetrates into the mass, the hydrocarbon gases and tar vapours being evolved shall be decomposed by contact in their passage through the envelope of red-hot carbon, depositing as much of the gasified carbon as possible, so that it is only the more stable hydrocarbon gases and the most volatile vapours that escape—ideal carbonization from the coke maker's point of view being the retention of the whole of the carbon in the mass.

In gas manufacture, on the other hand, in the ordinary process

employed at over 90 per cent. of gas-works, the coal used is as rich in resinic volatile matter as can be obtained without going to undue expense. Small charges are employed in order to reduce the time needed for carbonization, and also to reduce the contact with too large a surface of hot coke; and the temperature employed is limited only by its effect on the life of the refractory material used, and to avoid stopped ascension pipes and other troubles inseparable from overheating, and to continue the carbonization only long enough to drive out all volatile matter. Under these conditions, the gas yield is increased to the highest limits compatible with leaving in it enough hydrocarbon gases to comply with parliamentary requirements as to illuminating and heating value, and the coke is looked upon only as a bye-product that will pay a share of the coal bill—the ideal of carbonization from the gas manager's point of view being the conversion of the whole of the coal into gas, an ideal within measurable distance when using high heats obtained by employing 15 per cent. of the coke for heating the settings and converting the remainder into water gas.

It is clear that two ideals so fundamentally opposed to each other must be hard to reconcile; and in its broadest sense the question is simply: Given a definite weight of coal, how can it best be used to avoid waste and secure the highest monetary return, while at the same time satisfying the requirements of the various classes of consumers? Simple as the query seems at first sight, it is one that demands a consideration of the whole of the procedure in the various methods of carbonization practised. The class of coals used for making metallurgical and furnace coke are those which on heating fuse to a sufficient extent to convert the powdered coal into a pasty mass, from which, on slow heating, the volatile matters distil out; leaving a fixed carbonaceous residue which binds the free carbon into a hard mass.

It seems probable that the nature of the luting material between the particles when a coking coal is carbonized is entirely dependent upon the temperature attained and the length of time for which it acts. It is, in fact, the residuum of the least volatile portion of the coal. If the action has not been carried on for a sufficient length of time at a high enough temperature, hydrogen and oxygen will be found in it; and the last traces of these are very difficult to eliminate. It is only coal that contains a certain quantity of bituminous matter that will yield a well-caked coke. If we take coals containing a very high percentage of carbon, like anthracite or steam coal, they will not coke; and in the same way tertiary coals, like lignite, containing a large proportion of humus, will not coke. So that the largest proportion of coking coals come in the true bituminous class. Thus, the coals used for gas making are nearly all coking coals, with the exception of cannel, which is now very little employed, and in which the high ash content is a drawback.

The coking coals themselves, however, may all be divided into two classes: (1) The most bituminous, which give the largest percentage of gas and are so chosen for gas making; and (2) the less bituminous, which are the best for coke-works—the reason being that high gas yield means a high proportion of carbon lost as hydrocarbon gases, while this loss is less as the volatile matter decreases, enough, however, remaining to yield the pitch for binding purposes. The degree of heat and the rapidity with which the maximum temperature of the outer layer is attained affects the coking properties of some kinds of coal; and some of the South Staffordshire coals, which when slowly heated yield a friable mass useless as coke, will, when heated rapidly to a high temperature out of contact with air, yield a hard coke. This is due to the hydrocarbons all escaping as gases and vapours when slowly heated, while they are largely decomposed to pitch when they have to pass through an exterior mass of coke at a high temperature, and so yield the necessary binding material. Indeed, it is generally found that the coals showing the least caking power must be carbonized quickly at high temperatures if successful results are to be obtained.

With highly bituminous coals, like the Durham and Yorkshire, on the other hand, quick heating would lead to such frothing and swelling of the mass, owing to the large volume of the gases liberated, that it is difficult to carbonize them in any of the narrow chamber ovens; and when we are blaming the North Country coke makers for not adopting the more modern forms of oven and bye-product recovery plant, we should bear in mind that it is because they find the beehive oven far superior for the class of coal on which they have to work.

Origin of the Coke Oven.

When the idea of coking coal first arose, as might be expected, the same methods as in charcoal burning were employed; and heaps of coal were ignited on the ground and the combustion checked by coating with damp coal dust. A small advance was soon made by building a brick shaft or chimney with openings in the side to allow the passage into the shaft of the gases and volatile vapours issuing from the heap of coal piled around it, and so arranged that the largest coal was nearest the middle. The mass was ignited by burning coal introduced into the shaft, and air-inlets were made along the ground into the heap; the combustion being afterwards checked by coal dust, ashes, &c, spread over the outside. Such a method of carbonizing was most wasteful, but produced a good coke where a certain quantity of volatile matter was not a drawback; and "meiler coke," as it was called, is still made on a small scale.

In these processes, the heat was given partly by the combustion of some of the coal, and partly by the gases and vapours; and the meiler heaps soon began to be displaced by "oven" coking, that gave a more uniform product and a larger yield of coke.

The early ovens were heated entirely by the combusion of the vapours and gases, together with a small proportion of the coal, within the oven—no external heat being employed. These ovens, called "beehive ovens" on account of their domed tops, were 12 feet wide by 10 feet deep, and held a charge 10 feet in depth. The walls were 2 feet thick, and the ovens were built in groups to retain heat and minimize brickwork. They had a hole in the top of the dome, 2 ft. 6 in. in diameter, which could be closed by a plate, and an opening in front for charging or drawing, fitted with a sliding-door in an iron frame; the door being provided generally with air-inlets adjustable at will. The charge could be introduced either through the hole at the top or by the door; but it was found that the coke was of more even density if charged by the door, as when shot in from the top a dense mass of smalls was formed under the hole, which carbonized more slowly than the rest, and so gave a less uniform quality of coke.

In Silesia, ovens of much the same kind were employed; but the top was kept closed, a little air was admitted at the bottom and sides, and the gases and vapours were led by a side tube into a tank of water, where the tar condensed and gas escaped.

In both these forms of ovens, the new charge introduced fired from the bottom if the structure remained hot enough from the last charge; but as soon as the gas began to be evolved, it burnt above the charge, and the heat, spreading downwards through the mass, continued the carbonization. The completion of the action took from 84 to 96 hours per charge of 7 tons. At the end of this period, the top cover is put on, and the oven is allowed to cool down for twelve hours; the coke being then drawn by rakes and quenched with water. The beehive oven still rules supreme in Durham, Scotland, and America; and the latest form utilizes a portion of the waste heat, to do which the ovens are built back to back with a flue between them, the suck of a chimney shaft drawing the hot products of combustion and the incompletely burnt gases through the furnace space of a Lancashire boiler, and so utilizing them for raising steam.

Many more alterations have taken place in coke-ovens than with gas-retorts; and in dealing with the earlier forms, I can only glance at those that have proved most successful and were the forerunners of the present systems, which have now settled down to the beehive as the survival of the internally-fired oven, which is now the only remaining rival to the externally-fired bye-product recovery systems.

Many forms of coke-ovens were introduced in the sixties and seventies; the two most interesting being the Coppee and the Appolt—the former being the forerunner of the present recovery plant ovens, and the latter of the modern vertical retort. In the Coppee ovens, the carbonizing chambers were long and narrow, with sides slightly tapering from back to front, and about 3ft. 6 in. high. Crushed coal was fed into them from the top, and was carbonized by the combustion of the gases evolved from the coal, which escaped through openings in the side into flues between the chambers, where it met an air supply and burnt, heating the sides of the chamber. The ovens were built in batches, and were charged in rotation, so as to as far as possible equalize the heating value of the escaping gas, which is large in volume and high in calorific value during the first half of the carbonizing period, and rapidly falls during the second. When the action was completed, the coke was pushed out from the oven by a ram; both ends of the oven being closed by doors. These ovens were introduced at Chapeltown, near Sheffield, in the early seventies, and about the same time at Ebbw Vale, and contain many of the characteristics found in the modern recovery plant ovens.

The Appolt oven consisted of a rectangular structure containing twelve coking chambers or built-up rectangular retorts, having a top section of 3 ft. 8 in. by 13 in., and a bottom section of 4 ft. by 1 ft. 6 in., and between the chambers flues varying with the taper of the retorts. Vents in the side walls of the retorts allow the gases and vapours to pass into the flues, where, meeting the air supply, they burn and yield the necessary temperature. The retorts were fitted with doors at the top and bottom, so that they could be fed and discharged by gravity. These ovens were used as early as 1857 in the collieries of the Pas de Calais; and the large heating surface constituted a great advance on any previous form of oven.

About the sixties, various attempts were made to introduce ovens from which it would be possible to collect some of the bye-products. But no very successful result was obtained till about 1879, when Simon and Carvès introduced a recovery plant in which, taking the Coppee form of oven, they closed the side exits for the gas into the flues, and led it off by a dip-pipe and hydraulic main to condensers and scrubbers, which extracted the tar and ammonia; the gas being led back to the ovens and burnt in the flues to heat the chambers. Soon after this, ovens of the same character were introduced by Dr. Otto. They differ from the Simon-Carvès plant chiefly in the arrangement of the combustion and heating flues, and in making up for the loss of heat due to removing, cooling, and scrubbing the gas before combustion, by using Siemens regenerators to extract the heat from the flue gases and highly preheat the air used in the combustion.

Coke-Oven Gas for Town Supplies.

During the past thirty years, many improvements have been made in the earlier forms of recovery plant coke-ovens; and at

the present time only half the gas produced in the carbonization is needed for firing the ovens. This has led to attempts being made to so arrange the working of the plants as to fit them for the production of the gas supply for large towns—the economies incidental to working with large charges offering an important reduction in the cost of coal gas. When the Legislature abolishes the absurd trammels that bind the English gas maker to a standard of illuminating value, which means nothing, and adopts a standard of heating power, which means everything, some advance may be made in this direction in localities where there is a good market for metallurgical coke.

Northern Survival of the Beehive Oven.

In spite, however, of the enormous economies in coal, ammonia, and tar products, and improvement in atmospheric conditions brought about by the recovery plant, less than one-third of the coal used for coking is carbonized in such ovens—the old beehive oven still holding its own in the North of England, and polluting the air and wasting the commercial assets of the country to an even greater extent than it did in the first half of the last century, when it had the field to itself. To explain this extraordinary state of things, we must look beyond our insular prejudice and inertia. The real cause is, as we have seen, that the very "fat" gas coals of the northern fields do not lend themselves to carbonization in narrow chambers or vertical retorts filled to the utmost by ram or gravity; the great rapidity of evolution of the gas during early periods of the carbonization leading to such frothing up and swelling of the semi-fused mass on the exterior of the charge that trouble ensues.

Coke varies very much, not only in its chemical and physical characteristics, but also in external appearance. It may generally be accepted that with the same kind of coal the higher the temperature and the longer the exposure of the coke to it, the harder, more dense, and less easily combustible will it be; while the appearance is largely conditioned by the method of carbonization. In the beehive oven where most of the heating of the mass is from the top, the escaping gases from the carbonizing coal have to pass upwards through the whole mass of red-hot coke above, contact with which decomposes the hydrocarbons and deposits the carbon in almost metallic-looking films throughout the mass; and this gives the bright, light grey surface that used to be so highly prized in beehive coke. On the other hand, if all the gases are drawn away so as to prevent as far as possible excess of surface contact and pressure, this silvery appearance is not produced, and the coke looks black and dead, as is seen in gas, and also to a less extent in recovery oven, coke.

Some observers claim that this deposition in bright films is characteristic of the decomposition of methane, and is given only by this particular gas. But the difference in the form of the deposited carbon is due to whether it has been decomposed by radiant heat or by contact heat. If an easily decomposed hydrocarbon like acetylene is heated by passing between the walls of a very highly-heated tube placed vertically to lessen contact as far as possible, the radiant heat is sufficient to decompose it, and the carbon is deposited as a cloud. But where the hydrocarbon is more resistant, and comes in actual contact with the heated surface, then the carbon is deposited in a dense form as a film of great density, which in time builds up masses of retort carbon; and it is only when the film is very thin that the bright appearance is produced. The duller surface of recovery oven coke gave rise to great prejudice against it in the minds of the iron smelters when recovery plant was first introduced; but this was probably caused by the fact that, until the recovery plant was perfected, the heat being applied from the outside of the oven instead of the inside, as was the case with beehive ovens, the coke was not so thoroughly carbonized, and was softer and too easily attacked by the carbon dioxide in the blast-furnace, and so was not so strong or so economical in practice.

In most oven carbonization, the face of the coke nearest the hot wall of the furnace shows a curious undulated surface, consisting of discs 6 to 8 inches in diameter, and which are higher at the centres than at the periphery. These are generally known as "cauliflower heads" by the coke burners, and crevices of cleavage run into the mass from the lowest point to the area which was last heated to the fuel temperature in the carbonizing process. So regular are these appearances, and so like the columnar structure found in some formations, that they have sometimes been spoken of as if they represented a form of crystallization, which is, of course, wrong, as they appear to be formed from the escape of gases, which causes the whole mass to swell. After the first few hours this ceases, and a general contraction of the whole body takes place, which, being fairly even in every direction, fissures the coke in circular masses. If the coke is drawn when the volatile matter just ceases to come off, the heads are not found; but the crevices are there. The coke, however, is left heated to its highest temperature for a considerable period to harden it, and this causes further shrinkage, which, taking place mostly where the crevices have been formed, owing to the heat entering the mass most easily at these points, leaves the central portion between the cracks standing up a fraction of an inch above the densest parts.

Near the doors of the oven, black dull-looking masses of coke are often found, resembling gas coke, and known as "black heads." These are formed by the coke at this point not being sufficiently heated to complete properly the carbonization. As a rule it is found that the higher the temperature at which the oven has been worked, the more thorough has been the decomposition of the hydrocarbon gases and vapours passing through the red-hot coke, and the carbon so deposited increases the yield. High temperature and long exposure to the heat after carbonization is finished will also render the coke harder, denser, and less easily ignited.

The composition of the coal has so great an influence on the yield of coke that any comparisons of the percentage yield by the various forms of oven are bound to be misleading; but the alterations from the earlier forms of oven to the modern oven may be taken as representing a 10 to 12 per cent. greater yield of coke. Taking it very roughly, a good caking coal containing 87 per cent. of carbon would yield:

Carbonized in heaps	61	per cent. coke
,, ,, beehive ovens.	64	,, ,,
,, ,, Appolt and Coppee ovens . .	68	,, ,,
,, ,, modern recovery ovens . .	68 to 77	,, ,,

while the bye-products, tar, and sulphate of ammonia, also form an important asset.

The improvements in the recovery ovens since their first inception have been largely in the arrangement of the flues for heating the sides of the chambers; the superiority of vertical over horizontal flues being generally admitted, and allowing the necessary temperature to be attained with a consumption of less than half the gas produced by the carbonization.

A great difficulty that was found was to get even and continuous heating of the chamber walls, as when in the early Hoffman ovens the Siemens regenerative principle was adopted the alternate application of heat to only one half the chamber wall, the heating being alternated every half hour gave fluctuations in temperature which affected the carbonization and strained the brickwork; and the same trouble was found in the United Otto and in the Koppers ovens. In his later oven, introduced in 1905, Dr. Otto doubled the number of regenerators so as to reverse alternately in four sections; while Coppee, in his newest type, makes the reversal in five sets out of ten sets of flues. Collin extends the reversal to alternate flues; in this way ensuring the most even temperature.

Other alterations have been made in the handling arrangements and in the plant for the recovery of the bye-products, which are now nearly equal in quantity to those obtained in gas manufacture; so that, as far as the products of the carbonization go, we may state the approximate performances of the two methods as being:

	Coke.	*Gas.*	*Products.*
Gas making	13 cwt. of inferior coke, less 2·6 for heating	12,500 cubic feet 15-candle power	Tar, sulphate of ammonia, cyanogen, about equal.
Coke-ovens	14·2 cwt. superior coke	9500 cubic feet of 10-candle power, less 4500 feet for heating	

ESTIMATION OF CARBON MONOXIDE.

This was the subject of a paper read by Mr. L. A. Levy at the meeting of the London Section of the Society of Chemical Industry on Monday last week.

The author mentioned the various industries, &c., in which a rapid and simple quantitative test for carbon monoxide is of value, criticized the use of cuprous chloride absorbents, and then briefly described the various attempts which have been made to estimate carbon monoxide colorimetrically, using the reduction of palladium chloride solution or the formation of carboxyhæmoglobin in a dilute solution of blood. He showed that a very dilute solution of gold chloride, originally light yellow, turns red, owing to the formation of colloidal gold when carbon monoxide is bubbled through. This reaction was arranged as a colorimetric method of empirically estimating carbon monoxide. The author said the method was not employed to any extent, as the one described subsequently gave complete satisfaction. The gas containing carbon monoxide is drawn through a tube, containing iodine pentoxide and copper, maintained at a temperature of 150° to 170° C. in an air bath. The carbon monoxide is completely oxidized in carbon dioxide, and the gas next passes through an absorbing coil of particular shape, which contains a measured amount of standard baryta solution coloured with phenolphthalein. The solution becomes colourless after the absorption of 20 c.c. of carbon dioxide. The volume of gas is equal to that of the water which has run out of the aspirator into a measuring cylinder. If the gas to be analyzed contains unsaturated hydrocarbons or carbon dioxide, these must be removed by means of suitable absorbents before the oxidation of the gas. The measuring cylinder is graduated directly in percentages of carbon monoxide. For the estimation of traces of carbon monoxide, a solution of baryta of 1-10th strength is employed. Whether the percentage of carbon monoxide is large or small, the colour change is very sudden and readily observed. The results are accurate to within 0·5 per cent. of an ordinary Bunte analysis. An arrangement of the complete test in a handy and portable form was described by the author.

COAL-GAS PURIFICATION.

By HAROLD E. STONE, Central Laboratory, Birmingham.

[A Paper read before the Midland Junior Gas Engineering Association, Dec. 9.]

The author, in the course of his introductory remarks, said he did not intend to deal so much with purification plant, as with processes—since the former required separate treatment. He then proceeded to refer lightly to the early work of gas engineers in the purification field; and he then considered in greater detail the various processes which he had outlined.

THE LIME PROCESS.

This is the oldest process, and is based upon the alkalinity of the material. The reactions involved are quite simple. Supposing the gas treated contains both H_2S and CO_2, the latter is removed first; and only when its removal has been effected does the absorption of H_2S commence. This is accounted for by the fact that $CaCO_3$ is more stable than CaS, or, to put it another way, CO_2 is the stronger acid. The absorption of CO_2 is expressed thus—

$$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O.$$

The H_2S probably forms CaS at first—

$$Ca(OH)_2 + H_2S = CaS + 2H_2O.$$

CaS is a somewhat unstable body, and readily decomposes, giving Ca(OH) (SH) according to the equation—

$$CaS + H_2O = Ca(OH)\,(SH).$$

The lime is used slaked, and just moist enough to bind together. It should be slaked just before use; otherwise CO_2 will be absorbed from the atmosphere, and the material become partially spent.

At first, lime was used to absorb both H_2S and CO_2; and in many works—particularly small ones—it is still the only purifying material used. As an absorbent of CO_2 it works very well, since the product $CaCO_3$ is quite unobjectionable, and causes no nuisance. There have been proposals at various times to recalcine the spent lime and use it over again. The cost, however, is rather great, and consequently it is more economical as a rule to throw the $CaCO_3$ away and buy fresh lime as required. Spent carbonated lime usually contains about 60 to 70 per cent. of $CaCO_3$.

For absorbing H_2S, lime is not by any means ideal, however. The product is awkward to dispose of, owing to its objectionable smell, which is caused by the fact that CO_2 is capable of expelling H_2S from the calcium sulphides, owing to the greater affinity of CaO for CO_2 than for H_2S. As, soon, therefore, as the sulphided lime is turned out and exposed to the air, the evolution of H_2S commences, as CO_2 and moisture are thus brought into contact with the CaS. It was this trouble that helped the substitution of oxide of iron for lime as an absorbent of H_2S. Another drawback to the use of lime for the removal of H_2S lies in the fact that the sulphur is entirely lost.

The difficulty of the disposal of spent sulphided lime was got over at one time by blowing air through the purifying-box, and taking the gaseous products formed beneath the boilers. When this is done, care has to be taken that the purifier-grids are not damaged by the heat evolved. It is possible to clean up and revivify to some extent, by the use of air, a spent lime purifier which is passing H_2S. When this is done, the sulphur compounds are oxidized, with deposition of sulphur. This revivifying only goes on to a small extent, however, and cannot be depended upon. These considerations have caused the use of lime for H_2S extraction to be superseded almost entirely by the use of Fe_2O_3.

In many works, CO_2 is now not removed. Its effect on the illuminating power is not so important as it once was, since it is often cheaper to enrich gas by carburetted water gas or benzol than to take out the CO_2. The effect of CO_2 on the illuminating power of a flat flame is well known; but as these burners have become more or less obsolete, this effect is not important. On an incandescent mantle, the decrease in illuminating power is not nearly so great. The effect of adding CO_2 to gas burning in a bunsen burner is to shorten the flame as the proportion of air to gas becomes greater. This would simply mean that the mantle would not be full of flame. If, however, the air-regulator on the burner is now altered to less air, the full mantle is again obtained; and the only effect is that the number of heat units developed in a given time is slightly less with the gas containing CO_2 than with the pure gas. The net result on an incandescent mantle would be a very slight reduction in illuminating power—very much less than with a flat flame.

There is one condition of affairs under which CO_2 has to be taken out. This is when sulphur compounds other than H_2S are removed by the use of sulphided lime. This will be referred to later on. Apart from this last consideration, the question of removing CO_2 becomes one of cost only. If you can easily maintain the illuminating power at the parliamentary standard without removing CO_2, much space and trouble are saved on the works by leaving it in the town gas.

Reference has been made to the removal of sulphur compounds other than H_2S. Before the abolition of the sulphur clauses, this was a source of great trouble in gas-works. The material used was sulphided lime; and the gas treated was usually free from both CO_2 and H_2S, though removal of the latter is not essential. The sulphided lime was produced by having a lime-box following the CO_2 boxes, and before the oxide boxes. No CO_2 was allowed to go forward to this box. The position of the latter in the series was then altered by means of the centre-valve, so that it followed the oxide-boxes as well as the CO_2 purifiers. The absorption of the CS_2 in this sulphided lime box caused the liberation of a little H_2S, and check-boxes containing oxide had to be used last in the series.

The process of CS_2 removal has been investigated by Veley, who concluded that Ca(OH)(SH) was the active agent in the removal of this substance. The sulphiding of the lime forms CaS; and this decomposes, in the presence of water, giving Ca(OH)(SH), as before indicated. The Ca(OH)(SH) then reacts with CS_2 as follows:—

(1) $Ca(OH)(SH) + CS_2 = Ca(OH)_2$. $CaCS_3 + H_2S$.
(2) $3Ca(OH)(SH) + CS_2 + H_2O = 2Ca(OH)_2 + CaCS_3 + 2H_2S$.

No oxygen or CO_2 must be allowed to enter the sulphided lime box, or the absorption of CS_2 will be interfered with.

A revival of an old method of using lime has lately been reported in the "JOURNAL OF GAS LIGHTING." This consists in liming the coal before carbonization; and it has been developed at Cheltenham. The advantages claimed are many, and are fully set out in the report mentioned.

USE OF IRON OXIDE.

As already indicated, oxide of iron when first used was artificially prepared. Various kinds of natural oxide were then tried; and bog oxide appeared the most suitable. The reactions involved in the use of iron oxide are:

Fouling: (1) $Fe_2O_3H_2O + 3H_2S = Fe_2S_3 + 4H_2O$
(2) $Fe_2O_3H_2O + 3H_2S = 2FeS + 4H_2S$.
Revivification: $2Fe_2S_3 + 3O_2 = 2Fe_2O_3 + 3S_2$
$12FeS + 9O_2 = 6Fe_2O_3 + 6S_2$.

The most active form of oxide is that represented by the formula $Fe(OH)_3$ or $Fe_2O_33H_2O$. This is the composition of the precipitate, obtained by adding ammonia or caustic soda to a solution of an iron salt. Unfortunately, it is very unstable—easily passing to $Fe_2O_3H_2O$, when attempts are made to dry it. This is approximately the composition of the bog iron ore. The natural oxide contains some organic matter; but more is added to it (such as sawdust), to give greater porosity and to regulate the reaction to some extent. Care has to be taken not to add too much sawdust, or the material will become inert.

No great developments in the process of sulphuretted hydrogen removal have taken place in the ninety years it has been in use; but a number of minor improvements have been adopted. Every large works, in fact, has different ideas as to the best way of using oxide. The method of supporting the material in the boxes varies in different works according to the kind of grid used. The most common form is, of course, the flat grid; but hurdle grids, which allow of more material being put in the box are employed in several places.

Many attempts have been made to revivify the oxide *in situ* in such a way that a purifier would last until the sulphur content of the material reached from 50 to 60 per cent. without opening the box at all. This has so far not been successfully accomplished. The idea of introducing sufficient air with the crude gas to revivify the fouled oxide is as old as the use of oxide as a purifying material. Of late years, however, the air has been used to better advantage. One improved method is known as the reverse-action process. This consists in working a box first in the series until it shows foul. It is then put almost last in the series—being followed only by a catch; and a clean box is put first. The result is that the spent box has passed through it gas which is free from H_2S. A small percentage of air is admitted into the crude gas. A little of the oxygen is used up in the first box; but most of it goes forward with the clean gas to the last box, which is the spent one. There the oxygen is absorbed, with revivification under the best conditions, by the spent material. The principle underlying the process is that revivification cannot go on properly at the same time as the absorption of H_2S; and results obtained seem to prove the truth of this.

Another innovation consists in bringing the gas in at the top of the purifier and taking it out at the bottom. Several advantages are claimed for this; one of the most obvious being that the condensation which occurs when the gas enters the box, does not interfere so much, as the water can drain to the bottom of the box which is empty.

Attempts have been made to use oxygen for revivification *in situ*, but they have not been commercially successful, as the cost of producing oxygen is so great. If air is admitted for the purpose, it is best to put it in at the inlet to the purifiers. In many places the air is drawn in at the outlet of condensers. This is an easy place to admit the air, as condensers are mostly worked under vacuum. Some of the oxygen is, however, used up in the washers, and does not reach the purifiers. Of course, as purifiers are usually worked under pressure it is difficult to introduce air at this point.

With regard to the control of purifiers, it is advisable to have test cocks at all points. If it can be arranged to have a test cock communicating with every shelf, it will be found that the fouling of the oxide can be traced with ease through every box; and a good idea of how long a box will last before showing H_2S on the outlet can be obtained. It is useful also to keep a record of all oxide used—*i.e.*, percentage of sulphur and water, date on which

it was put into any box, &c. In this way, it is possible to judge whether the full value is being obtained from the oxide or not.

In large works, a mill for grinding the revivified oxide before it is put back into use is worth considering. As is well known, oxide which has been in a box for some time gets extremely hard, and is brought out of the boxes in large lumps. These lumps have to be broken up before the oxide is fit for use again. Breaking by hand is a long and expensive operation where hundreds of tons have to be dealt with; and a crushing mill does the work much more cheaply and with better results.

Use of Steam in Purifiers.

Dexter, in 1894, first called attention to this. He used a steam-injector to get the air for revivification into the purifiers; and he claimed better efficiency by doing so. Steam is certainly beneficial, and is best arranged so that either live steam can be injected or that it may simply pass through a coil in the bottom of the box. The live steam is useful in supplying moisture to the oxide and for breaking up any tarry matter which has accumulated in the pores of the oxide. The coil steam serves to remove superfluous moisture from the bottom of the box, and in winter to warm up the oxide a little, which has the effect of making it more active. Live steam is also sometimes used when opening a box. It helps to prevent the firing of the material. Also it is possible to partially revivify a box by admitting air and steam alternately. The steam prevents the revivification from getting too rapid, and causing firing.

Effect of Ammonia on Purification.

Ammonia has often been recommended as an aid to purification by oxide. Some have advised allowing a little to go forward past the scrubbers, and others have advocated sprinkling the oxide with liquor. The effect sought after in each case is the same—namely, the alkalinity of the oxide. There is certainly a tendency for the oxide to become acid during use; but it is questionable if the use of ammonia is a good cure for this. One of the chief reasons against the use of ammonia is the presence of quantities of cyanogen in the crude gas. The amount of this substance formed at the temperatures now in vogue is considerable. If cyanogen and ammonia are both present, a most corrosive mixture is the result, as the ammonia assists the destructive action of cyanogen. The corrosion of the boxes, meter drums, and gasholder plates is thus increased. The two latter suffer because the oxide never absorbs all the cyanogen present.

Effect of Cyanogen on Purification.

At one time, a fair portion of the spent oxide was sold on its cyanogen content. This was, of course, in the days when the demand for cyanides exceeded the supply, and when therefore all cyanogen compounds fetched a good price. At the present time, only a few works sell oxide on this basis. Most of them work up the oxide for sulphur and sell it on that basis. The cyanogen is extracted in the purifiers according to the following equations:

$$FeS + 2HCN = Fe(CN)_2 + H_2S.$$
$$9Fe(CN)_2 + 3O = Fe_2O_3 + Fe_7(CN)_{18} \text{ (prussian blue).}$$

If ammonia is present in the crude gas entering the purifier, the cyanogen is absorbed as ferrocyanide and sulphocyanide—much more of the sulphocyanide being formed than if the crude gas is free from ammonia. The following figures give some idea of the difference. The same volume of gas was passed at equal rates from a common supply simultaneously through: (1) Oxide only; (2) a small wash bottle containing a little ammonia solution and then oxide. The results obtained were:

	Fe_2O_3 only. Per Cent.		Fe_2O_3 and NH_3. Per Cent.
CN present as $Na_4Fe(CN)_6 10H_2O$ . .	3·3	...	3·4
CN „ NaCNS	1·0	...	2·7

The CN estimated as $Na_4Fe(CN)_6 10H_2O$ existed in the oxide as ammonium ferrocyanide, prussian blue, &c.; that estimated as NaCNS would be present as ammonium sulphocyanide.

There is no doubt that cyanogen shortens the life of oxide considerably. Dr. Bueb in 1900 stated that he found an increase of 50 per cent. in the life of oxide if the cyanogen was extracted from the gas before it went to the purifiers. This figure is probably rather high; but it seems obvious that particles of oxide coated with prussian blue are not going to extract H_2S so well as particles of oxide which are not deteriorated in this way. If lime is used before oxide, a fair amount of the cyanogen is absorbed in the lime boxes, and so does not reach the oxide. Cyanogen ought to be absorbed thoroughly in some portion of the plant, as with the high temperatures of carbonization now employed, the amount produced is much greater than used to be the case. Oxide of iron is not an efficient absorbent. The result is that cyanogen gets on to the district in small quantities, which have an accumulative effect. Several cases of corrosion of service-pipes and meters in Birmingham have been traced to cyanogen. One also often sees blue holder plates which ultimately become perforated, all due to the same cause.

Before leaving the subject of oxide purification, some brief mention should be made of a substitute known as "Weldon Mud," the use of which has again been revived. This is a product of the chlorine manufacturer, and contains manganese dioxide and lime as its chief constituents. In 1888, Hood and Salamon suggested its use instead of oxide. They gave the following as its composition after washing, to get rid of most of the calcium chloride always present in the commercial article:

MnO_2	28 parts
MnO	9 „
CaO.	11 „
$CaCl_2$	3 „
H_2O.	46 „
Insoluble matter . . .	3 „
	100 parts

The substance has a great affinity for H_2S, due to the oxide of manganese contained in it. Hood and Salamon gave the following comparison between Weldon mud and iron oxide as absorbents of H_2S. Under the same conditions, 100 parts of Fe_2O_3 took up 27 parts of S and 100 parts of Weldon mud 61 parts of S. The advantages claimed for it are:

1.—That revivification *in situ* is more complete than with iron oxide.
2.—That as the sulphur content increases; the back-pressure thrown becomes less.
3.—That as no organic matter is present the sulphur is more easily recovered from the spent product.

The sulphur can be recovered either by roasting the spent product, when sulphur distils off, or by treatment in a chlorine still with hydrochloric acid, when chlorine is evolved and sulphur left. This latter process was recommended by the patentees, who suggested selling the spent mud back to the chlorine manufacturer. Weldon mud is often used in the catch boxes, which follow the CS_2 purifiers, when sulphur compounds are being eliminated.

Liquid Purification Processes.—Processes Using Ammonia.

As already mentioned, the patents taken out by Hills form the basis of most of these processes. Ammoniacal liquor contains, as is well known, ammonium sulphides and carbonates in solution. These compounds are unstable bodies, and easily dissociate. At about 180° Fahr., this dissociation is complete. H_2S and CO_2 are much less soluble in water than NH_3. Thus, if liquor is heated to 180° Fahr., most of the H_2S and CO_2 passes off accompanied by some NH_3; while the greater portion of the NH_3 present remains in solution. This gives a method of causticizing liquor by simply heating it; and it was this method that was used in the best-known liquid purification process—the Claus process.

Claus Process.—Three operations were involved in the Claus process: (1) Purification of gas by ammoniacal liquor. (2) Decomposition of liquor thus formed, when CO_2 and H_2S are liberated. (3) Distillation of NH_3 from the residue. The plant used was very elaborate, and consisted of (*a*) five scrubbers, in which the gas was washed free from H_2S, CO_2, and CS_2; (*b*) four towers for removing H_2S (by CO_2) and CO_2 (by heating) from the liquor; (*c*) stills for driving off NH_3 from the H_2S and CO_2 free liquor.

The method of working was as follows: The spent liquor from the still was sent to the finishing scrubber, where it removed traces of ammonia from the purified gas. It was then sent to the second scrubber, where it met CO_2 free gas from the first scrubber and NH_3 from the stills. H_2S was absorbed. The liquor was thus strengthened up to about 21 oz. It was then brought into contact with lump sulphur, forming ammonium polysulphide. The solution thus formed was sent to scrubbers Nos. 3 and 4, where CS_2 was removed, as the gas in these scrubbers was free from CO_2 and H_2S. The resulting liquor then went to the first scrubber (No. 1), where it met crude gas containing the full amount of impurities. The CO_2 contained in the crude gas was here removed; and in its absorption, some H_2S was displaced from the liquor. In this way, the crude gas was purified from H_2S, CO_2, and CS_2.

The resulting liquor (from No. 1 scrubber) was then taken to the four purifying towers. In the first two it met CO_2 set free in the last two. This CO_2 liberated all the H_2S present—being itself absorbed. At the bottom of the second tower, any excess of NH_3 above what was required for the plant was drawn off. The last two towers contained trays fitted with heating coils, which heated the liquor up to 180° to 200° Fahr., when most of the CO_2 was expelled. From the last of the four towers the hot liquor went to the stills. The CO_2 and H_2S set free in the towers travelled in the opposite direction to the liquor; and these gases were finally washed in a fifth tower, with spent liquor from the still, in order to remove any traces of NH_3. The washed gases then passed on to a sulphur recovery plant. In the stills, the liquor was simply heated, and ammonia driven off. The spent liquor from the still was treated for recovery of CN.

From the above description, it will be seen that the process was very complete, and also very complex. It was tried at Belfast, with a 2 million feet per diem make, for some eight years. A full report by Mr. Stelfox is contained in the "Journal of Gas Lighting" for 1897.* The following few particulars taken from this report give some idea of the results.

The trial extended over about 1215 days. Out of this number, the plant worked 475 days—being shut down for repairs during the remainder of the time. The average efficiency was: H_2S, 66·5 per cent.; CO_2, 44 per cent.; and the ammonia sales dropped 50 per cent. The plant cost £14,500.

The process was thus a complete failure; and it is safe to say that this failure did more to stay the progress of liquid purification than anything else. The failure was most probably due to:

* See Vol. LXIX., p. 1475.

(1) The large number of vessels used; (2) the large amount of ammonia lost by mechanical means, owing to the fact that it had so much travelling backwards and forwards; and (3) mechanical breakdowns due to reason No. 1.

The loss due to exposing ammonia liquor to the air is often not appreciated. The following table taken from the "JOURNAL OF GAS LIGHTING" illustrates this, and indicates the need of great care when handling concentrated ammonia solutions.

Samples Exposed to Air in Beakers.

Sample.	Free NH_3.		Temperature Degrees Fahr.	Time Exposed.	Loss per Cent.
	Oz. Strength.	Grams per 100 cc.			
1	6·03	1·31	70	2 hours	8·5
2	8·62	1·87	75	40 hours	73·2

A modification of the Claus process by Holgate was much more successful. He used it in connection with a sulphate of ammonia plant; and it was this fact that helped greatly in its success. As in the Claus process, the liquor was heated to about 200° Fahr.; the H_2S and CO_2 set free being passed through the sulphate saturator and then to a Claus kiln. The hot liquor was cooled by passing over pipes containing liquor coming to the heater, and was then used in the scrubbers with good results.

PROCESSES NOT USING AMMONIA.

Feld's Process.—Many processes have been patented by Feld; and the latest is one which was tried at East Hull Gas-Works.* In this process a zinc salt is used as a vehicle for the removal of H_2S. To commence with, ZnO is suspended in water, and a mixture of SO_2 and air is passed in. The result is that zinc sulphite is formed. This is transferred to a Feld washer, where the following reaction takes place:

$$ZnSO_3 + 3H_2S = ZnS + 3S + 3H_2O.$$

The mixture of ZnS and S is then treated with SO_2 and air. This time zinc thiosulphate is formed:

$$ZnS + SO_2 + O = ZnS_2O_3.$$

The sulphur remains unchanged. The zinc thiosulphate, together with suspended sulphur, then passes to the washer, where more H_2S is absorbed:

$$ZnS_2O_3 + 3H_2S = ZnS + 4S + 3H_2O.$$

The mixture of ZnS and S is then again treated with SO_2 and air and the reactions thus proceed in cyclic order until the liquor contains about 15 per cent. of suspended sulphur. When this is the case, it is treated with SO_2 and air to get all the zinc into solution as thiosulphate. The liquor is then filter-pressed, and the sulphur recovered. The zinc thiosulphate passes on to be used again. Two Feld washers are used for the absorption of the H_2S. The SO_2 is made by passing air over the recovered sulphur which is heated in a kiln. The spent liquor from the washers goes to tanks *vid* a still. SO_2 and air are sent first through the tanks, and then through the still. The liquor is circulated through the still and tanks until regeneration is complete. It then goes to the storage tank, which supplies the washers.

A further modification of this process has since been proposed, in which not only H_2S is removed, but NH_3 also. In this case, $FeSO_4$ is used, instead of $ZnSO_4$. The method is as follows: The crude gas is washed with a solution of $FeSO_4$, when FeS is precipitated and $(NH_4)_2SO_4$ is formed.

$$FeSO_4 + 2NH_3 + H_2S = FeS + (NH_4)_2\,SO_4.$$

The liquor is now treated with a mixture of SO_2 and air, when the FeS is converted to FeS_2O_3 and sulphur is precipitated:

$$2FeS + 3SO_2 = 2FeS_2O_3 + S.$$

This mixture of iron thiosulphate and sulphur is returned to the washer, when FeS is again formed, together with ammonium thiosulphate:

$$2FeS_2O_3 + 4NH_3 + 2H_2S = 2FeS + 2(NH_4)_2S_2O_3.$$

The liquor is then again regenerated with SO_2 and air, and used in the washer (alternately) until the ammonia salts amount to about 30 per cent. The liquor is then heated and treated with SO_2 and excess of air. This effects the oxidation of the FeS to sulphate and of the ammonium thiosulphate to sulphate, with precipitation of more sulphur:

$$2FeS + 2(NH_4)_2S_2O_3 + 3SO_2 + 2O_2 = 2(NH_4)_2SO_4 + 2FeSO_4 + 5S.$$

The sulphur is then filtered off. There is now a mixture of $FeSO_4$ and $(NH_4)_2SO_4$, which is treated with crude gas, when the $FeSO_4$ is converted into FeS:

$$2(NH_4)_2SO_4 + 2FeSO_4 + 4NH_3 + 2H_2S = 4(NH_4)_2SO_4 + 2FeS.$$

The FeS is removed by filtration, and Am_2SO_4 is obtained from the solution. The FeS is used over again. This process gives Am_2SO_4 and free sulphur.

Burkheiser's Process.—This process is a very interesting one, and on quite fresh lines.† The following processes are involved:—

1.—Absorption of H_2S by means of special oxide of iron.
2.—Revivification of fouled material, with evolution of SO_2.
3.—Formation of ammonium bisulphite by action of SO_2 on ammonium sulphite.
4.—Formation of ammonium sulphite by action of ammonia on ammonium bisulphite.
5.—Oxidation of ammonium sulphite to ammonium sulphate.

A special purifying material is used at a temperature of above 100° C. The material is contained in a purifier as a layer 10 inches thick. The gas is heated by the hot SO_2 evolved from the oxide which is being revivified. H_2S is absorbed very rapidly by the iron oxide. When the oxide is spent, it is revivified by a blast of air. The sulphur burns to sulphur dioxide, and iron oxide is left. The iron oxide, however, contains traces of iron sulphate (ferric) and sulphuric acid, which have to be washed out. The iron oxide is then dried and used again. It has been found that the iron oxide after a time becomes inert and useless. The sulphur dioxide is absorbed in a solution of ammonium sulphite

$$H_2O + (NH_4)_2SO_3 + SO_2 = 2NH_4HSO_3.$$

The ammonium bisulphite thus formed is used to extract ammonia from the gas with reformation of ammonium sulphite.

$$NH_4HSO_3 + NH_3 = (NH_4)_2SO_3.$$

The ammonium sulphite is, of course, again used to absorb SO_2. And this goes on until a mixture of ammonium sulphite and sulphate precipitates out. The ammonium sulphate comes from the oxidation of the ammonium sulphite. The mixture consists, as a rule, of about one-third ammonium sulphite and two-thirds ammonium sulphate. This has to be all oxidized to sulphate.

The oxidation is an example of a reversible reaction; and when the above proportions are reached, an equilibrium is established —*i.e.*, any further oxidation is accompanied by a corresponding simultaneous reduction. To complete the oxidation it is necessary to upset the equilibrium by removing one of the constituents of the mixture. This is done by taking advantage of the fact that ammonium sulphite is sublimed at temperatures below 100° C., while ammonium sulphate is unaffected.

A vessel fitted with a worm conveyor is used. The vessel is jacketed one half with cold water and the other half with steam. The mixture is fed into the cold half of the oxidizer, and is conveyed along the worm until it reaches the hot portion of the vessel. Here ammonium sulphite sublimes, condensing on the cold portion of the vessel; being carried there by a current of air which enters at the hot end of the apparatus. This current of air effects the oxidation of the sulphite, which is scraped off the walls by the conveyor. The substance discharged by the conveyor consists of pure ammonium sulphate.

In conclusion, a few considerations of the future of purification may not be out of place. The results from the use of oxide are very satisfactory; but its disadvantages are great. The room occupied and the troublesome and unscientific process of charging and discharging the boxes are chief among these disadvantages. Although the cost of oxide purification is low, as soon as a successful process for purification in closed vessels is evolved, the disadvantages of the oxide method will be sure to cause it to be superseded. As to which process will ultimately be used—an ammonia process or one using an outside reagent—it is difficult to say. Both have their advantages and disadvantages.

The fact that there is only sufficient ammonia produced from each ton of coal to combine with about 33 per cent. of the total impurities means, of course, that with an ammonium process the ammonia has to be used several times over. On the other hand, the fact that it is produced in the gas gives it an advantage over outside reagents. Ammonia also suffers the disadvantage that it will not remove H_2S from a gas containing CO_2. The CO_2 is first removed, and then if any ammonia is left it combines with the H_2S. With outside reagents, secondary reactions often accompany the main reaction. This has the effect of making the reagent inert after a time, and causes trouble in controlling the process. The fact that several washers suitable for purification by liquids are available is sure to give a fresh impetus to the working out of a more perfect process.

[The paper was illustrated by experiments and lantern slides.]

Discussion.

The PRESIDENT (Mr. R. J. Rogers, Birmingham) said they were indebted to Mr. Stone for his paper, which was a very welcome addition to the "Transactions," inasmuch as they had not had a paper of this type since the Association started.

Mr. A. O. JONES (West Bromwich) said that, in the portion of the paper dealing with oxide of iron, the author mentioned the method of reversing the position of the boxes, and said this consisted in working a box first until it showed foul, and then putting it last in the series. He (Mr. Jones) thought the method most generally used was to put the foul box in the second position, and put a clean box in the first position. In this way, the first box was taking out all the sulphuretted hydrogen while the second box was being cleaned up. Steam was a great advantage in this process, because they not only got the benefit of the heat for helping the reactions to take place, but they had the moisture from the steam to replace the moisture carried away by the hot gases passing through the material. Mr. Stone also spoke about putting the gas in at the top of the purifier and taking it out at the bottom. An advantage of this was the fact that the moisture went on the top of the material, instead of going up through the grids and clogging them, with the result that they had less back-pressure

* An illustration of this will be found in the "JOURNAL," Vol. CVII., p. 816.
† This process was illustrated in the "JOURNAL," Vol. CVIII., p. 312, and Vol. CXV., p. 751.

by adopting this method. But owing to the fact that the steam got condensed on the cover of the purifier, the reaction was not quite so good. The author did not mention the question of temperatures at all. But it was a very important one; and for this reason he thought steam was a great advantage. At a low temperature the oxide got very sluggish. The temperature at which the reactions best took place was between 80° and 120°. It did not do to get the temperature too high, because of drying the material, and making it inactive in this way. He agreed with Mr. Stone that cyanogen was best extracted before it entered the purifiers. At West Bromwich, they had a process in which polysulphide of ammonia was used as the medium for the extraction of cyanogen; and they found in connection with this a slight decrease in the sulphur compounds, due to the compounds being used in the scrubber to form the cyanogen solution.

Mr. A. R. WARNES (Birmingham) suggested that it would have been better if the author had not used chemical formulæ throughout the text of the paper. If he had given the actual names, some of the substances referred to would perhaps have been more readily grasped. He would also have liked him to tell them something regarding "Lux." They saw a good deal about it in the technical journals; and he might have informed them whether it was a good or bad substitute for ordinary bog ore. He (the speaker) believed, though he was not quite certain, that it was made from the first two processes in the winning of aluminium by the electrolytic method. He thought it was a residue from the treating of bauxite with soda ash in a reverberatory furnace, and washing the resulting product with water. The iron oxide which went down was mixed with a small amount of sawdust—say, about 1 to 1½ per cent. There was also, he believed, an attempt to revivify burnt oxide of iron from the acid works; and perhaps the author could tell them something about this. With regard to the removal of CS_2, the author gave one process. Was there any possibility of calcium polysulphide being formed; and did this in any way assist in the removal of the CS_2? As to temperatures, to which Mr. Jones had referred, he thought it must be clear, to most of the chemists present, at any rate, that most substances reacted very sluggishly at low temperatures. On the subject of iron corrosion, the author mentioned that in Birmingham several cases of corrosion of service-pipes and meters had been traced to cyanogen. Here was something for gas-works chemists to investigate. In the course of some researches into tar-still corrosion, he (Mr. Warnes) found that the chief causes came in this order: Ammonium chloride, ammonium sulphide, and the cyanides of ammonia. And in some of the residues that he was able to gather, he found small traces of prussian blue—indicating, at all events, that cyanides had some action in the corrosion. As regarded the Claus process, it struck him that there was something more in it than had been mentioned in the paper. It seemed to him there was a method here which, properly worked, ought to prepare ·880 ammonia direct from gas liquor, without first of all forming ammonium sulphide and re-treating it. If this could be done, and done moderately cheaply, the manufacture would yield more profit than the working of the double process. Here was another chance for chemists in gas-works. Temperatures and pressures would have to be considered; but undoubtedly there was something in this matter which required more attention than had been given to it up to the present moment.

Mr. W. H. JOHNS (Saltley) remarked that Mr. Jones had referred to one of the matters that was in his own mind; and perhaps he might emphasize it a little more, by putting it in another form. He alluded to what was now known as the reverse action process of purification. There had been a lot of talk lately about this; and it was by some people considered to be quite a new thing. He, however, had known it for the last fourteen or fifteen years to be in operation very successfully at a great number of gas-works. There was therefore nothing very new about it. He thought Mr. Stone had gone a little bit astray in the order in which the purifiers were changed. To begin with there were four boxes—Nos. 1, 2, 3, and 4. The gas, as he understood the method, flowed through the four boxes in rotation. Immediately the second box showed a foul test, the last box was put first in the series; and they then had Nos. 4, 1, 2, 3. The next change brought the last box, which was now No. 3, first; and they then had Nos. 3, 4, 1, 2. The following change made the order Nos. 2, 3, 4, 1; and then they got back to the original sequence—Nos. 1, 2, 3, 4. This was what he always understood to be termed the reverse flow or reverse action method. Mr. Warnes had brought out a point with regard to burnt oxide. For many years burnt oxide had been used by some of the largest gas-works in London—particularly the South Metropolitan Gas Company, who burnt the oxide at their East Greenwich works for the manufacture of sulphuric acid, and then returned it to the gas-works to be used again in the purifiers. Some time ago, Mr. Joseph Tysoe read a paper on the subject before the Southern District Association of Gas Engineers and Managers;* and in it he gave some very interesting figures with regard to the process. His (the speaker's) own experience with the use of burnt oxide had been a disastrous one—in fact, the process had to be discarded entirely. Immediately a box was changed and put to work, they got a foul test at the outlet—showing that the burnt oxide was totally inert so far as sulphuretted hydrogen was concerned. With regard to "Lux," he had had some small experience of it; but in this case it had been used principally in a catch-box, so that he was not in a position to say much about it. They did not have to change the catch-boxes very often; and he was hoping that, by the use of "Lux," they would last even longer then they did before. They had used "Lux" material in some of the ordinary sets, and found it was very active the first time in the purifier—and the first time it came out. It fired very readily; and he should advise anyone who had had no experience with it to be ready with a good hose-pipe, to prevent an accident when the purifier-cover was being opened. No doubt, it was a very active material; but whether or not it paid to use it, he was not at present in a position to say. One had to look at these things right through to see, taking into consideration the extra cost of the material, whether at the end of the period—that was, when it was spent—it would have paid better to use "Lux" than ordinary oxide. Then in regard to the use of live steam in purifiers. At the majority of gas-works it was usual to admit (at the condensers or exhausters) from 1 to 2 per cent. of air to the gas; while at others they raised the covers of the boxes, and then, by means of a small fan or pump, forced air through the oxide in the purifier while the box was out of action. More care was necessary with the latter plan, because the temperature naturally rose, owing to the oxide becoming oxidized very rapidly. In his case, four iron rods were pushed down into the bottom of the oxide—one in each corner of the purifier; and the man who was attending to the oxide also had under observation the temperature of the rods. If there was an increase in temperature, the air-pump was slowed down. Before the air was admitted, they always allowed a little waste steam to enter the purifier—say, half-an-hour before air was blown in. The reason for this was, of course, obvious. With reference to the Factory Inspector's recent report as to the safety of the working of purifiers, his (the speaker's) instructions at the present time were that, as he had said, steam should be turned into the purifier for at least half-an-hour before the time of lifting the cover, with the plug at the top of the cover removed. After this period, he thought, it was fairly safe to go to work, because pockets of gas which might have been in the oxide would have been driven out by means of the steam. He did not wish to deal with the ammonia purification question that afternoon, because he had read a paper on the subject before the Association twelve months ago.* In conclusion, he proposed a hearty vote of thanks to Mr. Stone.

Mr. P. C. BALCON (Birmingham), alluding to the use of steam, said he thought they were all agreed that it was an advantage in purification; but it was not always an unmixed blessing. When they had a purifier of the Green type, with a flat lid, and by chance live steam was admitted, there was great possibility that it would soon be necessary to change the purifier because it would not pass gas. That was to say, it would get so clogged on the top layer that the back-pressure would become absolutely impossible to work through. He had had experience of this on some fairly small Green purifiers—about 10 feet by 10 feet. It was found that they could work better, and get almost equivalent results, by putting a steam-coil through the box and not using live steam. With Green's purifiers, the lids were made of wrought iron, and were very thin; and it was found that, by covering the lids with matting, and lagging the sides, and in this way keeping them warm, a considerable advantage was gained. With regard to what Mr. Jones had stated on the subject of the use of polysulphide, he (the speaker) had had some experience with a similar process, extending over two or three years, during which time a considerable number of tests were made at the inlet and outlet of the polysulphide washer. While occasionally a whole series of tests would indicate a small decrease in the sulphur compounds other than sulphuretted hydrogen, almost equally there were a number of tests showing an increase in these compounds. In working with "Lux," as Mr. Johns had said, at the beginning it was extremely active, both in and out of the purifier; but he thought they would find that, after being in three or four times, its activity diminished very considerably. With burnt oxide, using oxide from the sulphuric acid manufacturers, as Mr. Johns had also said, results up to now had not been satisfactory. Some they had experience of awhile ago set in the purifiers almost to the consistency of concrete—in the meantime not doing very much towards removing sulphuretted hydrogen. One firm he had in mind took, he believed, a lot of oxide, recovered the sulphur, and disposed of the residual oxide for purification. He would have liked Mr. Stone to tell them in his paper rather more than he had about the practical working of the Burkheiser process. He knew it was not easy to get hold of practical details of processes like this; but he believed the Burkheiser system was working on the Continent.

Mr. F. SHEWRING (Droitwich) said they were all aware that, in the larger works particularly, oxide had been introduced to the displacement of lime. He found to-day that, with the more advanced use of sulphate of ammonia, there were many soils that required an amount of lime in some form. Of course, years ago farmers used a quantity of the waste lime from gas-works on their land; and since they had been unable to obtain it, they had found that their crops had not been so good. It was necessary, in order to get good results in the case of many crops, to have a fixed percentage of lime in the soil; and, although in years gone by this was added, not with any real intention of bringing up the percentage of lime in the soil, but was put on, he understood, with the idea of killing the wire worm, still the actual result was to increase

* This paper will be found in the number of the "JOURNAL" for Nov. 19, 1907, p. 565.

* See "JOURNAL" for Nov. 15, 1910, p. 489.

the chalk value of the soil. When the land was dressed in the autumn with lime, and sulphate of ammonia was applied in the spring, the results were considerably better; and he could assure them that farmers in many parts of the country were feeling the pinch of oxide purification. The author had mentioned that the boxes became acid at times. He himself had had experience of this. Where he had found a slightly acid reaction, the boxes had become practically inert; and it had occurred to him that, after the oxide had become inert, the introduction of a percentage of "Lux," which was of a very active nature, would considerably assist in making the oxide work in a satisfactory manner.

Mr. C. C. Barber (Adderley Street) said several speakers had mentioned "Lux." He had had it in use for perhaps eighteen months now, in boxes working as catch-boxes. Whereas before using "Lux," as soon as sets showed foul they had to change a box, now when a set showed foul they let it go to the catch-boxes. The result was that, instead of two boxes a week, they only changed one now. Some reference had been made in the paper to the liming of coal. He had been trying this for a short time; and the results he had obtained might be of interest to the members. The primary object was the reduction of the sulphur compounds. He had found that they secured a reduction of about 65 per cent. by the addition of 2 per cent. of slaked lime to the coal. Before lime was used, there were 35 or 36 grains of sulphur compounds per 100 cubic feet of gas; whereas now they had got as low as 4½ grains—the average being about 12 grains. Stopped pipes had been decreased very materially. Before lime was added, they averaged ten stopped pipes a day; and this number had been reduced to two. There was practically no effect on the coke. They could see a little speck of lime here and there; but it was really not noticeable. The yield of ammoniacal liquor had increased by about 11 per cent. The sulphuretted hydrogen in the crude gas had been increased—probably by the decomposition of the sulphur compounds—by 0·2 or 0·3 per cent. The cyanogen contents of the gas had been doubled. He seconded the vote of thanks to the author for his paper.

The Hon. Secretary (Mr. W. J. Pickering, Birmingham) remarked that the author had traced the history of purification in an interesting manner; and it was noteworthy how certain ideas had persisted right up to the present time, with little or no change. It was mentioned that water-luted covers and hydraulic centre-valves had remained in use until now. He thought they might still venture to hope that, instead of failure, liquid purification would allow of the evolution of a process which should be satisfactory from all points of view. It was known that many processes tried had led to complete failure; but he thought in this direction lay the hope of the future. It would be beneficial in many ways if a process could be evolved which would make use of those vertical washers which would allow, as the Feld did, of more easily cleaning out and afford greater facility for the handling of the material.

Mr. Warnes, alluding again to burnt oxide, said it struck him that something ought to be done to save it for future use in the gas-works. He could quite understand burnt oxide not turning out a success when it was taken direct from the oxide burners, and expected to again purify gas; and it suggested itself to him that it was necessary to treat the burnt oxide by some process before it could be used satisfactorily to purify gas. He believed that attempts had been made; and he did not think they were altogether successful. He was not acquainted with the paper by Mr. Tysoe to which reference had been made. Perhaps the South Metropolitan Gas Company did treat their spent oxide before they put it into use.

Mr. Johns: I think a little lime is added.

Mr. Balcon said the oxide he was speaking of was, he thought, prepared specially for the purifiers after being burnt.

Mr. Warnes remarked that it had been discovered that many soils were acid, and that certain bacteria which were necessary for the well-being of plant-life could not thrive in these acid soils. It became necessary therefore to treat the soil in some way to render it slightly alkaline; and there was no doubt the old idea of putting lime in the soil carried out this action which was necessary to the life of the bacteria. With regard to gas lime, the Board of Agriculture advocated its use very largely for various fungus diseases; and some of the potato root diseases could be treated very satisfactorily by digging in the lime after the diseased potatoes had been pulled out of the soil.

Mr. Jones pointed out that when he referred to the use of polysulphide of ammonia for the extraction of cyanogen, he did not mean to give the impression that it would extract all the sulphur compounds in the gas. It was not a cure for sulphur compounds at all.

Mr. Stone, in the course of his reply, said he was afraid he had not explained quite fully enough the operation of the reverse action process. He had merely indicated the principle. The working details given in the discussion were, he believed, the correct ones. He had not given exact temperatures in his paper, as different oxides required different temperatures. It was a matter of experience really to ascertain what was the best working temperature. There was the steam-coil; and they could get just what temperature they desired. In the summer, he did not think it was necessary to use the steam-coil much. In the Claus process, sulphur compounds other than sulphuretted hydrogen were extracted by ammonia polysulphide, so that it was obvious under certain conditions polysulphide would take out sulphur compounds; but in the Claus process they did not treat the gas containing carbon dioxide with polysulphide, and consequently by using a polysulphide washer in the position in which it was employed at Mr. Jones's works they would not get a great deal of sulphur compounds taken out. He agreed with Mr. Warnes that names, rather than formulæ, would have been better in the text of the paper. As to "Lux," he did not know how it was prepared; but from what he had seen of it in use, it appeared to be very satisfactory. It was certainly very active the first time. Whether the fact that it was not so active the second time was due to not adding sufficient water, or whether it wanted more alkali added, he could not say. As to the employment of burnt oxide, as Mr. Balcon had said, he had seen it so set that it had to be got out of the boxes with chisel-bars. This was a prepared oxide. Whether it was possible to prepare a satisfactory oxide, he did not know; but it would be a great saving if it were practicable. His experience, however, had been most unsatisfactory. As to corrosion by cyanogen compounds, he had personally examined stuff obtained from meters, and had found, not traces, but quantities of cyanogen compounds, and also ammonia. The use of the Claus process for making pure ammonia had been mentioned. He believed this had been done at a considerable profit. The exact data, however, were kept secret. Mr. Balcon had related his experience with the use of live steam in some Green's purifiers. But these boxes were very small; and it was a question whether they would get the same clogging effect with larger purifiers. He believed the Burkheiser process was being used on the Continent on a fairly large scale, but not exactly on what one would call a working scale. The results secured by Mr. Barber with coal liming appeared to be very similar to those experienced at Cheltenham. Several people had tried to explain them; but no one seemed to have done so satisfactorily. There did not appear to be any reason why liming coal should prevent stopped pipes. Dr. Lessing gave an explanation; but he did not know that it was altogether satisfactory.

LINING STEEL PIPES WITH MORTAR.

The protection of steel pipe is a matter which water-works engineers have been studying for a good many years, because the life of any main, provided it is not damaged by electrolytic action, depends very largely upon the effectiveness of its inside coating in resisting corrosion. It has been considered good practice to dip steel pipe in a hot bath of coal-tar pitch and raw linseed oil, or coat it with any of the acceptable compounds now on the market. An inside lining of portland cement mortar has, however, been used by the Metropolitan Water Board of Boston on the approaches to their Newton pressure tunnel, and by the Board of Water Supply of New York on the syphons of the Catskill aqueduct. On both pieces of work the pipes were large—6 ft. 8 in. diameter at Boston, and 9 ft. 6 in. at New York.

Referring to this matter in a recent issue, "Engineering Record" said: Though cement lining for small pipe is no novelty, it is not so frequently encountered in large-size sections. The advantage of the mortar lining is two-fold—it not only forms a permanent protective coating for the steel, but also adds to the hydraulic properties of the section. By covering the rivet heads on the inside of the pipe with a smooth mortar lining, the eddying of the flowing water is largely reduced, and the carrying capacity of the pipe increased. Various schemes for applying thin mortar linings to large steel pipe have been tried. Mortar has been shot upon the inside surface from a nozzle and hose-line by compressed air; but at Newton the use of inside steel forms and pouring grout into them from the top constituted the method employed. Before the work was undertaken, there were predictions from several sources that the pouring of a mortar lining only 2 inches thick was not a practicable proposition. It was feared by those who decried the proposed plans that it would be difficult, if not impossible, to produce a smooth, impervious lining, on account of the pocketing of air in the thin annular space between the forms and pipe. The experience so far of the Metropolitan Water Board, however, proves that it is entirely feasible to secure a good lining in this way. On account of the thinness of the mortar coating, the inside forms have to be adjustable to produce a lining of the required depth, and special precautions have to be taken to prevent the lining from cracking when the forms are removed and water under pressure admitted to the finished conduit; for if there are breaks in the lining, the water comes into direct contact with the metal, and corrosion will eventually injure the steel.

Coke-Oven Gas in Belgium.—It will probably be remembered that some weeks ago the Municipality of Ostend invited tenders for supplying the town with coke-oven gas. We learn from an article in the Engineering Supplement to "The Times," reproduced elsewhere, that the contract has been given to the Compagnie d'Eclairage de la Flandre, who proposed a price of 3·95 c. per cubic metre (about 10½d. per 1000 cubic feet) for their gas, which the Municipality will supply to the consumers. It appears that a concession has been granted to a Company for the supply of coke-oven gas to Verviers at the rate of 5 c. per cubic metre, or 4 c. for quantities in excess of 5 million cubic metres (176½ million cubic feet) per annum, exclusive of distribution charges; and that negotiations are in progress for supplying gas-works in the Mons district with gas obtained from coke-ovens.

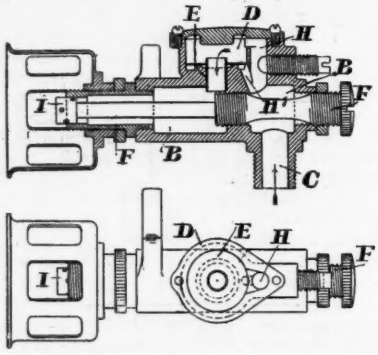
REGISTER OF PATENTS.

Supply of Gas to Burners.

RICHMOND GAS STOVE AND METER COMPANY, LIMITED, RANSOME, J. A., and DIXON, L., of Warrington.

No. 26,508; Nov. 15, 1910.

This invention relates to regulatable atmospheric gas-burners of the kind having automatic governor devices; the object being "to provide a burner of this type which is simple, compact, and inexpensive, at the same time is effective in respect both of regulation and governing." The burner is designed to be placed and used horizontally, as in gas-fires or heating apparatus of various kinds. In the burner there is a regulating spindle, having a plug or diaphragm part between its ends, filling the box of the chamber or conduit, and dividing it into two parts—an inlet and a discharge part. A governor chamber on the top of the body or casing communicates with the inlet part of the chamber by passages, and with the discharge part by the hollow stem of the governor valve.



Ransome and Dixon's (Richmond and Co.) Gas-Regulating Valve.

The casing (as shown) has within it a horizontal chamber or conduit B, to which the gas enters at right angles at one end by the inlet branch C, and discharges at the opposite end to the place of mixture with air. Above B is the box D, in which an automatic governor valve E works. This governor valve is of the usual float type—a circular horizontal disc, centrally mounted on a hollow cylindrical stem, which projects both below and above the disc. The portion of the stem below the disc passes and works through, and in, an aperture in the wall of the casing between the main conduit and the governor chest. The stem forms the outlet for the gas from the governor chest to the chamber B.

The hand-actuated gas-regulator consists of a spindle F with the end nearest the gas entrance meshing with an internally threaded portion of the chamber B. Beyond this part, there is another threaded portion (of the same diameter as the first portion) meshing with an internally threaded part in the casing, and forming a septum in the chamber B, so as to divide it into compartments. Beyond this part, the spindle is of smaller diameter; and at the extreme end is provided with a rose head I, filling the conduit at this end. The rose head is so constructed that, by screwing out and in, a larger or smaller number of holes are uncovered, and more or less gas is free to flow to the point where it mixes with the air. The part of the spindle which is between the two threaded portions is vertically above the gas-inlet C and vertically underneath the inlets HH^1 to the governor, so that the gas, on entering the first part of the conduit B, can flow only between the two threaded portions, and so into the governor.

The outlet of the governor is situated on the opposite side of the threaded portion of the spindle to the inlet C; so that the gas can only flow along first into the first portion of the chamber B, thence through the governor chamber D and valve E, and then to the other part of the chamber B, and so to the rose I.

Lighting Gas from a Distance.

ANDERSON, H., of Edinburgh.

No. 10,285; April 28, 1911.

This is an improvement in lighting apparatus such as that in which fulminating pellets are fed forward by mechanism beneath an oscillating hammer in proximity to a jet of escaping gas; the pellets being exploded by the hammer. Time mechanism is ordinarily used to turn the gas on and off and to actuate the hammer or else to turn on and off and ignite the gas by heat produced by friction. There is proposed for the production of sparks the use of cerium-iron alloy in conjunction with a metal oscillatory scraper; the sparking devices being placed outside the flame. In some cases the handle which actuates the gas-cock serves to place a spring under tension and afterwards release it; the tension of the spring being utilized for rubbing two substances together, so as to produce a spark when brought into frictional contact. The handle or the sparking device may alternatively, if desired, be actuated by means of a lever and two tension cords.

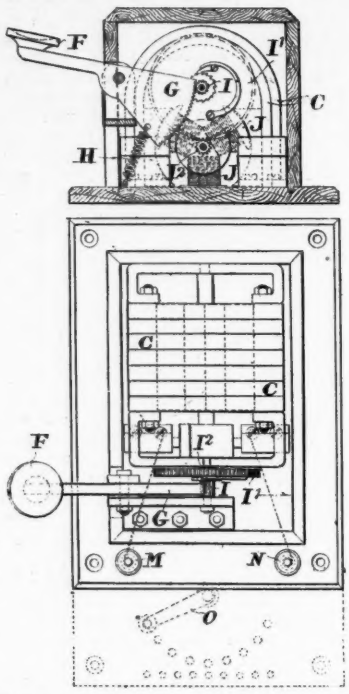
Gas Lighting and Extinguishing Apparatus.

CANNING, T. F., of Ilford, Essex.

No. 27,986; Dec. 1, 1910.

This apparatus for lighting gas refers to the type in which a magneto dynamo has a sudden impulse imparted to its armature by means of a hand-operated handle.

It has been proposed, the patentee points out, to make this type of apparatus portable; but it is, to the best of his knowledge, novel to fix the apparatus on some convenient place and connect it to one or more points at which the gas can be lighted (even though the points may be out of ordinary reach or the reach of portable apparatus) "to all intents and purposes as easily as an electric light can be turned on by a switch." This forms the main feature of the invention. The current generated may be employed to light the gas by a spark or incandescent wire, or if a bye-pass gas-light is employed, the current may actuate an electro magnet and turn the gas tap on or off.



Canning's Electric-Switch Lighter for Gas-Lamps.

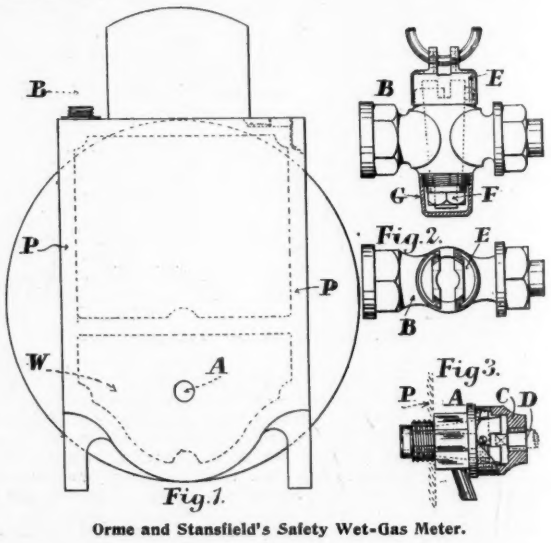
The case shown has fixed within it a plurality of magnets C, arranged in double form and bolted to the base. A finger lever F is pivoted on a bracket, and has on its inner end a toothed segment G (controlled by the spring H), adapted to rotate the pinion and ratchet mechanism I and to turn the wheel I^1 which drives at an increased speed the pinion I^2 of the armature J, the spindle of which is supported in brackets. The current is collected from the commutator by spring-controlled brushes, and is conducted (shown by dotted lines) to the terminals M N. The multi-way switch, shown by dotted lines, enables the current to be conveyed to any desired circuit by turning the lever O over the contacts connected to their respective terminals.

Wet Gas-Meters and their Valves and Keys.

ORME, T. A., STANSFIELD, A., and METERS LIMITED, of Manchester.

No. 29,336; Dec. 17, 1910.

This invention covers means whereby the gas inlet and the water outlet of a gas-meter cannot be "on" or open at the same time, because there exists only one operating device for both—detachable only on the closure of one.



Orme and Stansfield's Safety Wet-Gas Meter.

Fig. 1 is a diagram of a wet gas-meter, and indicates where the valves can be conveniently fitted. Fig. 2 shows the gas-control valve. Fig. 3 illustrates the waste-water outlet valve with masked plug.

A valve A is fitted to the cover-plate of the waste-water chamber W, or into the syphon channel or pipe, or in other appropriate position,

as the cover-plate P. The valve A embodies a revolvable plug and a water drainage outlet screwed in place into the cast-iron cover. The head of the plug has a key-way formed in it, and is masked by a slotted cap or cover C, so designed as to admit the operative end of a key D whereby the plug can be turned; but when the plug is so turned to the "on" position, the key cannot be removed. When the plug is "off" or closed, however, the key is easily withdrawable. There is also fitted in the length of pipe leading to the meter a gas-control valve B with a plug with head fashioned with a key-way to be engaged by the key. The head of this plug is masked by a slotted cover or cap E, which will allow the key to have access to the plug head, but will retain the key when the plug is returned to the "on," or open, position. The system, consequently, provides an absolute safeguard, because one valve must be closed before the other can be opened—that is, with the water-drainage valve open, the gas-valve is closed, or *vice versâ*.

To prevent tampering with the plug of the gas-control valve, the usual holding-down nut F, at the foot, is enclosed by a cover or thimble G; also, to prevent access to the masked plug in the case of the gas being cut off and the key taken away (as when a house is empty), the ears of the cap may be bored, and a padlock passed through it and sealed.

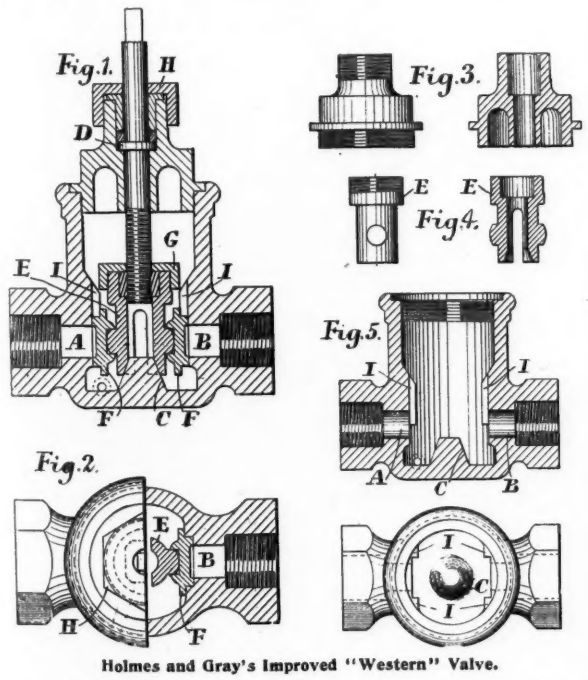
Valves.

W. C. Holmes and Co., Limited, and Gray, H. A. B., of Huddersfield.

No. 6118; March 11, 1911.

This invention relates to "Western" slide-valves, in which two or more passages are controlled by discs actuated by a single screwed spindle; the object being "to produce a valve suitable for controlling small passages—say, for example, of ½-inch diameter—in which the spindle can, when so required, be withdrawn without opening the valve, or removing the valve from the line of pipes in which it is placed."

In such a valve the rotary spindle passes through a removable cap or cover, and has a fast collar, and a nut or bush engaging a central dependent or internally projecting portion of the cover. The screw-threaded inner end of the spindle enters a yoke, preferably formed of mild steel and split to permit of a spring action being obtained. The yoke is provided with projections engaging the sliding discs or valves proper, with a tapered recess at one end adapted to engage a conical projection on the valve body, and with an enlargement at the other end to receive a nut on the spindle. The enlargement is screw-threaded on the outside for the reception of a screw cap in contact with the nut; the cap thus transmitting to the yoke the outward movement of the nut longitudinally of the spindle—its inward movement being communicated directly to the yoke. The valve being closed, the spring of the yoke holds the yoke and the sliding discs in the position in which they have been placed; so that, on the cap or cover being removed from the valve body, the spindle can be withdrawn, or the stump of it, if broken, can be twined back out of the nut which is under the yoke cap.



Holmes and Gray's Improved "Western" Valve.

Fig. 1 is a vertical section of the valve. Fig. 2 is a plan (half in section). Fig. 3 is a side elevation and section of the removable cover detached. Fig. 4 is a side elevation and section of the valve yoke detached. Fig. 5 shows a section and plan of the valve casing.

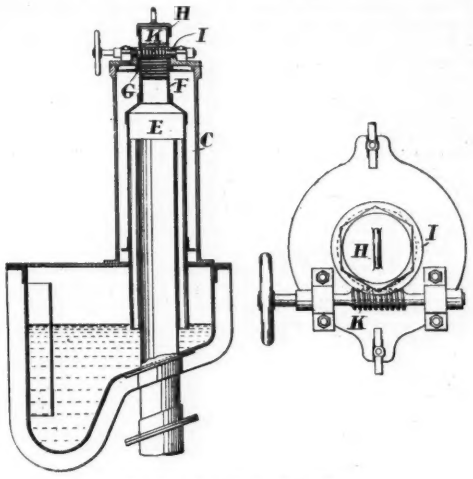
The valve casing is provided with ports A B and a conical projection C. The rotary spindle has a fast collar D, and on the lower end of it works a nut approximately square (see fig. 2). The split yoke E, which, when the valves are closed, embraces the projection and which has projections carrying the sliding discs or valves F, is enlarged to accommodate the square nut. The cap G is screwed down on to the yoke E, thus placing the nut in operative connection with the yoke. Another screwed cap H encloses a gland at the top of the spindle—the latter working freely through both caps. The spindle being rotated so as to draw up the square nut, the yoke E and valve discs F are raised so as to open the ports A B; the discs moving between guides I.

Dip-Pipes.

Clark, F., of Southend-on-Sea, and Cutler, G. B., of Millwall, E.

No. 8700; April 7, 1911.

This invention has for its object to facilitate the exact and positive adjustment of the dip-pipes, which are fitted with wheel nuts that rest on the top or lid of the containing chamber and can be rotated by a worm mounted in bearings on the top or lid. By this arrangement, the dip-pipe can be adjusted and held in any desired position; while by simply removing the cover, the ascension pipe is left free to be cleaned by an auger inserted through the extension of the bell or dip-pipe.



Clark and Cutler's Dip-Pipe.

The illustration shows the suggested arrangement applied to a hydraulic main as described in patent No. 7381 of 1907.

The ascension pipe passes into the chamber C above it. The dip-pipe E is formed with a screw-threaded tubular extension F projecting through an opening G in the lid of C, and is itself fitted with a screw cap or cover H and with a worm-wheel nut I that is engaged by a spindle K mounted in bearings on the lid of the chamber C.

The arrangement is such that, by actuating the worm spindle K, the dip-pipe can be raised and lowered according to requirement either during gas making or when charging or discharging retorts. The dip-pipe will be held in the exact position to which it has been adjusted until the nut I is again actuated. Further removal of the cover H affords (without interference with the adjusting mechanism) a clear way through the extension F for inserting the cleaning tool into the ascension pipe.

Gas-Meters.

Compagnie pour la Fabrication des Compteurs et Material d'Usines à Gaz, of Paris.

No. 10,840; May 4, 1911. Date claimed under International Convention, May 9, 1910.

This invention, relating to dry meters, has particular reference to meters in which pivoted slide-valves are employed for distributing the gas.

The essential part of such meters is, the patentees point out, constituted by membranes of leather or special fabric enclosed in a metal casing, and which, owing to a special system of distribution, are displaced alternately in both directions by the pressure of the gas supplying at each pulsation a predetermined volume of gas and actuating recording mechanism suited to the purpose for which the apparatus is used. The operation of these meters is, therefore, comparable to that of any reciprocating machine actuated by a fluid under pressure; and every form of distributing gear employed in these machines—such as plane slide-valves, circular or cylindrical slide-valves, poppet-valves, and so forth—can be utilized with them. Hitherto, however, distribution by means of a flat slide-valve has been practically the only method employed, "as it would appear that the other systems have not given satisfactory results."

The patentees claim as their invention: "Distributing means for membrane gas-meters (termed dry meters) characterized by the fact that slide-valves are adapted to oscillate simultaneously with an alternating angular movement around a common fixed point with which they are each connected by an arm forming an extension. These slide-valves move over a valve plate common to them both, in which ports are formed communicating with the measuring chambers. The displacements of the slide-valves control the admission and exhaust apertures by the intermediary of crossed connecting rods, which receive the movement of the bellows and act upon the slide-valves by means of known mechanism for transforming movement."

They point out that the novel slide-valve referred to combines with the advantages of the flat slide-valve with rectilinear movement (from the point of view of the small amplitude of its movements and the small extent of the surfaces in contact) the advantages of the circular slide-valve as regards the constant precision of the guidance, "without presenting the inconveniences of these two methods of distribution." It is also noted—and this feature is one of the most important of the invention—that the part constituting the seat of the two slide-valves not only unites all the meter orifices, but also all the distribution passages necessary for the circulation of the gas. Consequently, when it is fitted to the meter it is only necessary to cause the two sides of each membrane to communicate alternately with the inlet and the outlet by the operation of the slide-valves.

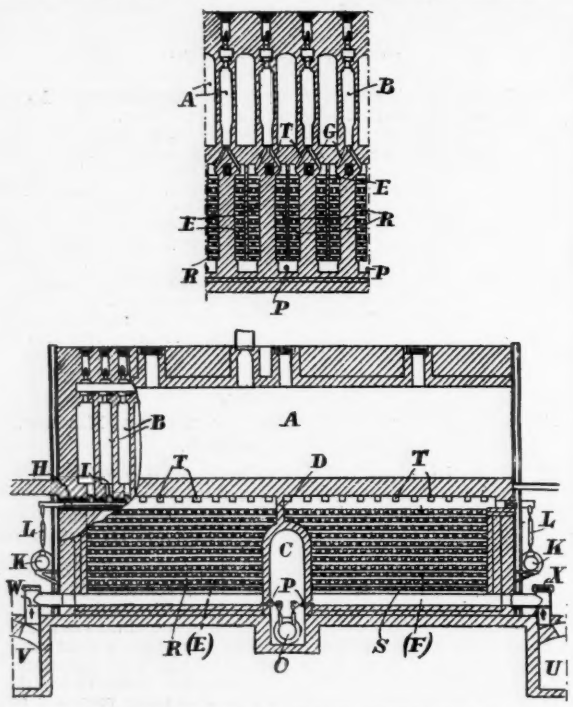
Convertible Gas-Retorts and Coke-Ovens.

KOPPERS, H., of Essen-on-the-Ruhr, Germany.

No. 8725; April 7, 1911. Date claimed under International Convention, April 15, 1910.

Commencing his specification, the patentee says: In the working of large chambered ovens or retorts for producing gas and coke—that is to say, retorts which have in the main been evolved from the modern coke-oven—the fluctuations of the market and industrial conditions make it desirable that the plant should be capable of being used alternatively as a gas-retort and as a coke-oven. Inasmuch as the ovens usually have regenerators, the alternative use involves different conditions in regard to the preliminary heating of the heating gases, according to whether part of the distillation gas itself, or gas from a separate producer or generator, is to be used for heating the oven. In the one case, it is not practicable to preliminarily heat the distillation gases, owing to the ready decomposition of the same; while with generator gas of inferior value it is not only possible, but necessary to preheat.

The present invention provides a solution of the problem involved by the change in the working, and is characterized by the heating walls of the chambers—*i.e.*, the several heating flues—being provided with means for direct admittance of gas from a special channel and also with means connecting each to two regenerators. For one of the two alternative modes of operation, the regenerators are used solely for preliminary heating of the air for combustion; while the gas-channel conducts the excess of gas from the ovens and in some cases hot generator gas as well. For the second mode of operation (with preliminary heating of generator gas admitted cold), the special gas-channel is disconnected, and one of the regenerators connected with each heating wall or flue is used as an air-heater and the other as a gas-heater. A type of oven suited for this arrangement is described in patent No. 28,811 of 1904, in which the regenerators are arranged beneath the battery of ovens, directly parallel with the heating walls.



Koppers' Convertible Gas-Retorts and Coke-Ovens.

The illustration shows in cross section a battery of ovens, and a longitudinal section of one of the heating walls and chambers.

The heating walls B, arranged between the chambers A, are connected by passages G with the regenerators E F, which are arranged in series in the path of the gas currents, and are separated by the arch C and wall D. The heating walls also communicate, by passages T, with the similarly arranged regenerators R S. The flues in the heating walls are divided into two sets; and the two sets in each wall are connected in series, so that the gas burns upwards in one and passes downwards in the other. The regenerators are correspondingly divided. Each flue B communicates, by a nozzle I, with a gas distributing passage H, formed in the brickwork, and connected by a pipe L to one of the gas-mains K. The regenerators R S are connected by pipes P with the separate gas-conduits O. The regenerators S F are connected to the discharge conduits U by conduits controlled by valves W; and the regenerators E R are similarly connected to the discharge conduits V. All regenerators have closable connections X communicating with the atmosphere or with passages running along the battery.

The manner of using the apparatus is as follows: If the excess of gas, which is of a nature not enabling it to be heated, is to be used for heating the oven, the conduit O is completely closed and the regenerators connected with the atmosphere, and are also alternately connected with the discharge conduits U V by operating the valves W X. Heating gas admitted from the gas-main K to the passages H is burnt in the flues B of one half of the oven, and descends through the heating flues of the other half, whence it passes through the regenerators arranged parallel with the heating flues into the discharge conduit. The draught may be reversed in about half-an-hour by the usual valves.

If the working is to be conducted with pre-heating of both combustion agents, the supply of gas through pipes L is cut off, and the valves X are closed, so as to disconnect the regenerators R S from the atmosphere, While the regenerators E F are worked as described, the regenerators R S are used for pre-heating the gases admitted through the conduits O, by alternate connection to the conduits. In this case, also, the draught is reversed after the usual period of about half-an-hour; so that a normal recovery of heat with preliminary heating of gas and air is attained.

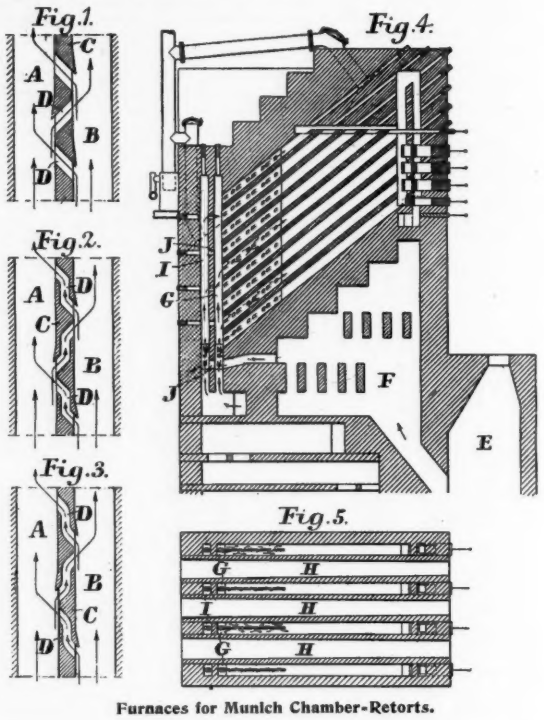
Mixing Heating Gases and Combustion Air in Retort-Furnaces.

OFENBAU-GESELLSCHAFT M.B.H., of Munich.

No. 15,287; June 30, 1911. Date claimed under International Convention, Aug. 11, 1910.

This invention relates to the chambers or passages for the heating gas and combustion air in retort-furnaces and the like; and it has for its object "to improve the mixture between the combustion air and the heating gases."

To ensure the most uniform heating of the walls of the retorts or chambers in retort-furnaces, the heating gases must, the patentees point out, be mixed as thoroughly as possible with the air required for their combustion; and combustion must not take place suddenly at the point where the gases meet the air, but in a gradual and progressive manner. According to the present invention, this object is attained by providing in the partition which is arranged between the flues for mixing the heating gas and combustion air, straight, stepped, or curved transverse conduits alternately inclined in opposite directions, whereby gradual mixing of the heating gas and combustion air is effected by the draught induced by the chimney.



Furnaces for Munich Chamber-Retorts.

Figs. 1, 2, and 3 show, in vertical section, various forms of flue according to this invention. Fig. 4 is a vertical longitudinal section of an inclined retort-furnace, in which the conduits for supplying the heating gases and combustion air, as well as the heating flues, are provided with transverse conduits. Fig. 5 is a horizontal section of fig. 4.

The inclined cross flues or conduits D are provided in the partition C, which separates the flues A B for mixing the heating gas and the combustion air; the flues D being inclined in opposite directions in such manner that they rise alternately from right to left and from left to right. Owing to this arrangement, the draught induced by the chimney acting in the flues A B will result in the heating gas being drawn through alternate openings from the flue A into the flue B; and, conversely, the air from the flue B into the flue A through the inclined transverse conduits. In that way, a gradual and complete mixing of the gases and the combustion air is said to be ensured. Each transverse conduit D is preferably provided at its mouth with a sharp edge, which projects into the flue A or B and divides the current of heating gas or air which strikes it into thin layers, which are deflected into the transverse flues.

In the inclined retort-furnace shown, the arrangement is such that the partitions with transverse flues built into the heating gas and air supply flues of the furnace first bring about a preliminary mixing of the heating gas and the air, while, owing to the partitions in the bottom portion of the longitudinal heating flues also having inclined transverse flues formed in them, "a thorough mixing of gas and air takes place in the actual heating flues, and, further, there is a completely uniform, gradually increasing, combustion of the mixture of gas and air."

The heating gases from the producer E pass into the chamber F, and

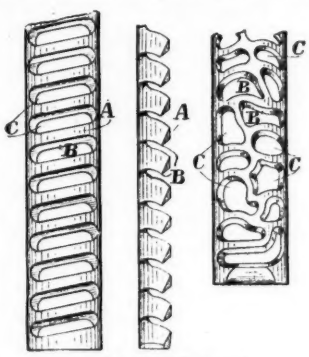
flow through a conduit into a vertical heating gas supply flue G, into which open longitudinal heating flues constituted by the lateral walls of two adjacent retorts or chambers H. Beside the vertical flue G is arranged a vertical air supply flue I, which is separated from the flue C by a partition, in which are provided at certain distances perforations by which communication is established between the flues G and I. Through the undermost perforation J a part of the heating gases also passes into the bottom portion of the vertical air supply flue. The combustion air, after being subjected to preliminary heating in the regenerator, passes from the horizontal flue into the bottom portion of the air-supply flue, and a part of the air also enters directly the bottom portion of the heating gas supply flue. To improve the preliminary mixing of the heating gas and combustion air, partitions are provided in the bottom portion of the flues to divide the bottom part of each flue into two mixing flues. In these partitions are arranged alternate inclined conduits, so that the mixture of gas and air formed in the bottom portion of the flues is carried in the direction of the arrows, and thus subjected to further mixing.

Fuel for Gas-Fires.

WILSON, C. E., of Armley, near Leeds.

No. 15,396; July 3, 1911.

Instead of forming the interior surface of the fuel of comparatively large area, as is usual, the patentee proposes to form each division A taper, terminating in a knife edge or thin rib as at B; the taper being downwards, so that the edge may be subjected to the action of the flame. Thus there are a series of apertures C bounded by downward



Wilson's Gas-Fire Fuel.

tapering walls A. While, the patentee remarks, "the apertures C appear to be larger than those in the ordinary fuel, this is not so, yet the strength of the fuel is not decreased." The flame playing on the downward projecting ribs or knife edges B and readily heats them, and the heat is transferred to the outer edges or surfaces. To construct the fuel an inner mould forms the upper taper of a rib and an outer mould the lower one. On looking down into the fuel, the sloping or inclined construction is said to direct the eye on to the back ribs and not through the fuel to the fire-back, "and therefore only the glow of the fuel and flame is visible."

Direct Extraction of Ammonia.

PÜNING, H., of Münster, Germany.

No. 22,357; Oct. 10, 1911. Date claimed under International Convention, Oct. 10, 1910.

The direct extraction of ammonia from the gases of distillation has hitherto been accomplished, the patentee mentions, by passing the gases into sulphuric acid, which absorbs the ammonia; but when the gases are "impurified by tarry matter," as it is usually the case, the resulting sulphate of ammonia "will be more or less impurified."

By means of the process forming the present invention, the sulphate of ammonia will be obtained by passing electricity into the gases of distillation to free them from any "tar-fogs." To this end, high-tensioned electricity is passed, by the aid of points or edges, into the gases, whereby the tar-fogs are eliminated. These gases of distillation, after being freed from the tar-fogs, are then led into the sulphuric acid, and yield a pure sulphate of ammonia.

No further details of the process are given in the Specification, the claim for which is: "A process for the extraction of ammonia in shape of a sulphate destitute of tar from gases of distillation of coal, peat, wood, and the like, characterized thereby, that the tar-particles of the gases of distillation otherwise impurifying the sulphate of ammonia are removed by passing high-tensioned electricity into said gases of distillation before they are led into the acid bath."

Harrow and Stanmore Gas Company's Profit-Sharing Scheme.—As readers of the "JOURNAL" are aware, the Directors of the Harrow and Stanmore Gas Company a short time ago decided to introduce a profit-sharing scheme; and the first meeting in connection with the arrangements was held in the Baptist Mission Room, Harrow, last night. It was explained that, under the scheme, a bonus, calculated according to the price of gas, will be given to the officials and workmen on their ordinary salaries and wages, exclusive of overtime. If the price of gas is at or above 4s. per 1000 cubic feet, there will be no bonus; but below this figure it will be ½ per cent. for every 1d. reduction. So that if the price drops to 2s. 6d., the bonus will be 9 per cent. To give the scheme a good "send-off," the Directors have decided to date the bonus from the beginning of the present year. The proceedings at the meeting will be noticed more fully next week.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

International Smoke Abatement Exhibition.

SIR,—Will you permit me to thank you for the appreciative reference to the above exhibition which appeared in your last issue, and to explain that the exhibition will be held from March 23 to April 4, and not in May as was originally intended, and as you announce. The change of date was made to meet the views of manufacturers who felt that a Smoke Abatement Exhibition would be more popular if held earlier in the year than in May.

Will you further permit me to correct what may be an erroneous impression in regard to the attitude of the Institution of Gas Engineers and the Society of British Gas Industries. The exhibition is under the patronage of the Institution, which has appointed its President, Mr. R. G. Shadbolt, to represent it upon our Council and on Special Gas Sub-Committees. In their individual capacity, too, many members of the Society of British Gas Industries are members of the Exhibition Council—including the Chairman of the Society and the Chairman of its Gas-Stove Section. Indeed, no one can say that gas interests are not adequately represented at the exhibition, as among other Vice-Presidents or Members of Council are Mr. Corbet Woodall, Mr. D. Milne Watson, and Mr. Goodenough, of the Gaslight and Coke Company, Mr. Charles Carpenter and Mr. M'Leod, of the South Metropolitan Gas Company, Mr. Charles Hunt, Mr. Shoubridge, Mr. J. W. Helps, and the Chairmen of various Provincial gas undertakings—such, for instance, as Sir William H. Stephenson of the Newcastle-on-Tyne and Gateshead Gas Company and Mr. Hanbury Thomas of Sheffield.

I need scarcely add that the electricity and other interests are represented in a similarly adequate manner.

It is quite certain that the exhibition will be largely supported; and I may be permitted to express a hope that the makers of gas-stoves and other appliances will see that the industry in which they are specially concerned is represented by a really comprehensive display.

LAWRENCE W. CHUBB, Secretary.
Coal Smoke Abatement Society.

25, *Victoria Street, S.W., Dec.* 8, 1911.

[Our correspondent's letter is dealt with in our leading columns to-day.—ED. J.G.L.]

The Whole Truth and Nothing but the Truth.

SIR,—In your issue of Nov. 28, p. 597, you give a comparison of competitive schemes for flame arc and high-pressure gas-lighting.

From the figures given, I recognize, I think, the draper's shop to be in the district in which I am concerned; but, either in design or in error, you do not give the lowest quotation submitted by the electricity suppliers.

Instead of an annual fixed charge of	£86 8 0,	the fixed charge was	£65 0 0
Instead of maintenance, supplying carbons, &c., to be at	25 0 0,	the actual charge was	16 13 4
Instead of the inside lighting costing	15 12 6,	the actual quotation was	13 11 8
Total	£127 0 6	Total	£95 5 0

Making a total of £95 5s., against the total given in your article of £127 0s. 6d.—a very big difference.

Further, you are very careful not to state that this particular customer found that high-pressure gas did not light his windows as they ought to be lighted; and he has since had to instal electric light in the windows, the cost of which for the year will amount to about £18. So that the comparison should be as follows:—

High-Pressure Gas Lighting.		*Electric Light.*	
Cost as given in article	£71 10 4		
Add cost of necessary electric light, owing to high-pressure gas being unsuitable for windows	18 0 0		
	£89 10 4	Total cost of electricity supplied	£95 5 0

If I have made a mistake, and the premises do not happen to be in the district in which I am concerned, will you be good enough to suppress this letter. But if I have not made a mistake, in fairness you should publish it.

As all names up to the present have been suppressed, I enclose my card and sign myself

"NOT GOOD ENOUGH."

Dec. 4, 1911.

[In one particular, our correspondent is correct. The first competitive quotation we published on p. 597 of our issue for Nov. 28 does refer to premises in his district; and not only "in fairness" do we publish his letter, but we do so with unfeigned pleasure, as it enables us to expose the sort of competition that gas companies have to meet from some municipal traders in electricity supply. The letter is certainly not "good enough," nor does it convey "the whole truth, and nothing but the truth." It is "the truth and the whole truth" that we want; and the customer whose installation is here in question, being a lover of fairplay, has no hesitation at all in affording facilities enabling us to arrive in this instance at that desirable end. Let us take the first table in the letter. Our correspondent says that either "in [*sic*] design or in error," we do not give the *lowest* quotation submitted by the electricity suppliers. At the time publication was made in our

columns, we had no notion that there was any but the original quotation made by the electricity suppliers to the customer in question; but that original quotation was the one that was given in competition with the high-pressure installation which was adopted, despite the subsequent lower electricity tender. The lower tender appears to have been prompted by the panic of the electricity suppliers over the ill-success of their efforts to secure this customer. They did not want high-pressure lighting to go in here; and they were out to buy the lighting at any price. Their first offer was £127 os. 6d. That estimate was dated March 16 of the year in which this competition took place. The second estimate was £95 5s.; and this was given on April 2—or two-and-a-half weeks later. Between these dates, the electricity canvassers were hot at work trying to prevent the lighting of these premises going to high-pressure gas. There is a difference of £32 between the first and the second estimates; and, so far as can be ascertained, the electricity suppliers, in addition to dropping £32 on an estimate of £127, offered to give a slightly higher candle power than the proposed gas-lamps. But their estimate was still nearly £24 in excess of gas. The second electricity offer shows that it was proposed to give more current for much less money. Now if £127 was the correct figure on March 16, how came it that a municipal electricity undertaking, in little more than a fortnight, found they could do something better for about 25 per cent. less cost than the original offer? Is this municipal speculation to keep a rival out at any price? That is not all. To further disclose the length to which these municipal traders were prepared to go to keep out high-pressure gas lighting (we do not think this will be denied), an offer was made, in writing, by them to the effect that, if the consumer felt that he was committed to the Keith plant, they would purchase it at a fair valuation, subject (if it is remembered rightly) to confirmation. If there is no denial of this on the part of our correspondent "Not Good Enough," we ask is this fair trading on the part of a municipal electricity-department; and do their statutory powers enable them to enter into dealings of this kind? We only wish our correspondent had, by the publication of his name and address, given us the opportunity of showing the inner side of this business to those who would make serious and good use of it. Now we come to the second part of the letter—that referring to the inside lighting. First, our correspondent accuses us of having been careful not to state that this particular consumer found that high-pressure gas did not light his windows as they ought to be lighted, and of withholding the information that he has since *had* to instal the electric light in the windows, the cost of which for the year will amount to about £18. Now is it just of our correspondent to say this so long after high-pressure lighting has been installed, and has given satisfaction? The customer knows best why the electric light was installed inside the windows. It is due solely to the character of the window dressing he is adopting. His own statement is that the true cause of the installation of electricity in his windows is that he is creating a Christmas bazaar; and, desiring the current for mechanical toys, he has at the same time had ten 100-candle power lights fitted, to be used on special occasions only, and to suit the particular dressing of the windows. He authorizes the assertion that the cause of the electrical installation being due to the inefficient high-pressure gas lighting, is an absolute misstatement. Furthermore, he cannot understand on what assumption the calculation of £18 is based, seeing that he has no contract for this amount, and, if he so determines, the consumption of current need not cost more in shillings than the pounds mentioned by our correspondent. There are ten 100-candle power lamps installed; and the calculation is for these ten lights. The cost of their installation was £13. A further four lights are being installed in the window of another shop. But the instructions for these have only just been given; so that the calculations have no reference to them. There is another point. The original electrical scheme provided for lighting inside the shop to the amount of 3232-candle power for £15 12s. 6d.; then, we now learn, it dropped to £13 11s. 8d., which is equal to 3·26d. per hour for the 3232-candle power. Now the estimate jumps up, for the inside window lighting only, to £18, or 4·32d. per 1000-candle power, or 1 06d. per hour more for one-third the candle power offered for £13 11s. 8d. Truly, the ways of electrical purveyors are remarkable! The customer would no doubt be pleased to learn whether the old offer of £13 11s. 8d. is still open for 3232-candle power, instead of the £18 for the 1000-candle power. We have here shown on the customers' own statement that it is not true that the electric lights were installed through any illuminating deficiency of the high-pressure lamps; and that therefore it is not right to add the £18 to the £71 10s. for gas-lighting. Even if it is added, the total then works out to £5 14s. 8d. less than the second offer of the panic-struck electricity suppliers. Without the £18, the difference in cost between gas and the second electrical offer is about £23 15s.; and between gas and the first offer, £55 10s. 6d. Truly, our correspondent's statement is "not good enough," nor can it claim place in the category of "the whole truth, and nothing but the truth." We must ask the "Engineering Correspondent" of the "Daily Telegraph" not to make inquiries as to the identity of our electrical correspondent.—Ed. J.G.L.]

The "Engineering Correspondent's" Reply.

Sir,—I am sorry to say that, owing to great pressure of other work, I must keep you waiting a little before analyzing your editorial criticism.

I think it only fair to draw your attention—and that of your readers—to the article on gas-furnaces appearing in Monday's issue of the "Daily Telegraph." Further, it may be worth mentioning that for several years the writer has strongly advocated that sort of load—heating for gas-works.

"Engineering Correspondent," "Daily Telegraph."

Dec. 8, 1911.

Coke-Quenching Plant.

Sir,—On perusing the record of patented inventions in the "Journal" for Nov. 28, I observed No. 13,518, for coke-quenching apparatus by Mr. Donald M'Donald, of Louisville, Kentucky, U.S.A.

I beg to say this is exactly the form of coke-quencher that we have had in use here for the past four years, with the exception of the details of the pivoted pan at the bottom. The bottoms of our quenching hoppers are contracted, and sealed in a segmental shaped pan, similar to those in use at the bottom of the earlier forms of the Glover-West vertical retorts.

Our idea was not patented, as I do not consider there was anything very novel in the arrangement. I think it only fair to the American patentee, however, to mention this matter; and I am interested to know that a brother gas engineer on the other side of the globe has been working on similar lines to myself.

Wm. Wilson, Engineer and Manager.

Falkirk, Dec. 4, 1911.

Vertical Retorts.

Sir,—We have noticed in a recent issue of your esteemed paper that prices have been given of the cost of various vertical retort and horizontal systems In each case the cost of our settings has been stated to be higher than that of other vertical retorts, whereas in reality the reverse is the case.

The price of our settings in England, erected complete—with house, conveyors, and all necessary working parts—is from £125 to £140 per ton of coal carbonized, varying with the size of the plant, the local conditions, and the requirements of the engineer.

Woodall-Duckham Vertical Retort and Oven Construction Company, Limited.
per A. M. Duckham, Managing-Director.

Palace Chambers, Westminster, Dec. 4, 1911.

LEGAL INTELLIGENCE.

CLAIM FOR COMPENSATION BY A GAS MANAGER.

At the Thetford County Court recently, before his Honour Judge Mulligan, K.C., John Stinton, formerly the Working Manager of the Brandon Gas Company, sued the Company for compensation for the loss of a leg, due, as alleged, to an accident which happened to him in the course of his employment. Mr. Rowley Elliston appeared for the applicant; Mr. A. W. F. Bagge represented the Company.

In support of the claim, it was stated that on the morning of July 27, 1910, when engaged in drawing the retorts, a lid fell on to applicant's left foot. He remained at work for a few weeks, but had to give up on the 18th of September. A medical man was sent for, and applicant was treated for rheumatic gout. Being dissatisfied, he called in Dr, Harris, of Thetford, who diagnosed the complaint as gangrene of the lower half of the foot. The line of gangrene corresponded with the seat of the injury. Dr. Harris saw it was a case for operation; and on the 18th of October the applicant was sent to Addenbrooke's Hospital at Cambridge, and shortly afterwards was operated upon—the lower part of the foot being amputated. This was not altogether successful, and on the 20th of December the left leg was taken off below the knee. On the 4th of January he returned home. On coming out of the hospital, in consequence of something which was said, he gave notice to the Company and the matter passed into the hands of solicitors.

Applicant gave evidence in support of this statement. He said he had been in the employ of the Company for eleven years, and had had good health. After the accident, the Company paid him full money up to Sept. 29, then £1 a week to Oct. 13, and 10s. a week to May 31. On the 9th of January, Mr. Brown, the Secretary of the Company, called to see him, and asked him to write a letter to the Company with regard to the accident. He did so; and sent a letter to the Chairman and Directors. He then put the matter into the hands of solicitors. At the end of July, Mr. Brown brought him a receipt for £10, which was offered in full settlement of any claim; but he refused to sign it. He was now in receipt of outdoor relief. In cross-examination, witness said there was no one with him in the retort-house when the accident occurred, and, with the exception of his wife, he did not tell anyone about it at the time. He did not tell Dr. Lowther, who first attended him, about it, nor the doctors at Cambridge. He never gave notice to the Company, because compensation never crossed his mind.

Dr. Alfred Harris said he saw Stinton on the 25th of September, 1910, and found him suffering from gangrene. The line on the boot just about corresponded with the seat of the injury. From the examination he made, there was nothing to suggest that gangrene was due to anything else than the accident; and, in his opinion, this was the cause of it.

Mr. W. Brown, the Secretary of the Gas Company, said that he first heard about the accident at the end of November, 1910, from Mrs. Stinton; and he told her she must ascertain from her husband the particulars, and let him have them, in order that he could lay the matter before the Insurance Company. The particulars were sent a

week after Stinton left the hospital. He (witness) went several times to see him; and the Chairman accompanied him in September. There was no claim for compensation when the first payments were made, and he had not heard of any accident then. The payments were continued by order of the Directors. The Company always treated their servants well.

Medical evidence was then given. Dr. Lowther deposed to attending the applicant and finding him suffering from rheumatism; and he gave a certificate to this effect. He was never led to suspect gangrene in the front part of the foot. Dr. R. P. Hick, House Surgeon at the Addenbrooke Hospital at the time Stinton was there, said he found him suffering from gangrene of the lower half of the left foot; but he did not consider it could have been caused in the way described. The accident might cause blocking of small arteries, but would not affect the main supply of blood to the foot. If due to the accident, it would have been moist gangrene; and he did not see how it could arise nearly two months after the occurrence. Dr. Arthur J. Cleveland, Honorary Assistant Physician at Norwich Hospital, said if the suggestion put forward that the accident was the cause of the gangrene was right, it was a unique case, and against all teaching hitherto accepted. He had had considerable practice in these cases, and in his opinion the accident was very unlikely to have caused the gangrene.

Counsel on both sides having addressed the Judge, his Honour said he would take time to consider his judgment.

THE VALUATION TANGLE IN EDINBURGH.

The Valuation Appeal Court for Scotland sat in Edinburgh last week, presided over by Lord JOHNSTON, Lord SALVESEN, and Lord CULLEN.

Among the cases heard on Friday and Saturday, were appeals by the Edinburgh and Leith Gas Commissioners against decisions by the Valuation Committees of the City of Edinburgh and the Burgh of Leith. The question raised was whether landlords' taxes and feu-duties ought to be deducted from the sum brought out by the approved calculations, before the valuation was fixed. The Assessor for Edinburgh fixed the total valuation of the undertaking, and allocated it at £102,820 within the City of Edinburgh, £3303 within the town of Leith, and £2515 within the county of Midlothian. The authorities in the three areas within which the undertaking is situated sought deductions, in respect of landlords' taxes and feu-duties—reducing the valuation in Edinburgh to £94,982, in Leith to £3051, and in Midlothian to £2323. Parties were heard before all three Committees; and each decided the case differently. In Edinburgh, the Committee refused to allow either of the deductions asked, and affirmed the decision of the Assessor. In Leith, the Committee allowed landlords' taxes to be deducted, but not feu-duties; and fixed the valuation at £3059. In the county of Midlothian, the Committee allowed both sums to be deducted. The Commissioners acquiesced in the Midlothian decision, but appealed against the other two, fixing the valuation at £2323.

There appeared on behalf of the appellants (the Gas Commissioners): Mr. CONSTABLE, K.C., and Mr. J. D. MILLAR; and on behalf of the respondents (the Assessor for Edinburgh): Mr. COOPER, K.C., and Hon. W. T. WATSON. Mr. LIPPE appeared for the Leith Assessor.

Mr. MILLAR, in opening the case for the appellants, said there were two cases; but the same question was raised in them both. He explained that the Gas Commissioners' undertaking was situated in three different areas—Edinburgh, Leith, and Midlothian; and that while the Valuation Committee of Edinburgh had refused to allow their contention that landlords' taxes and feu-duties should be deducted from the valuation, the Leith Valuation Committee had deducted the landlords' taxes, but not feu-duties, and the County Valuation Committee had allowed the deduction on both heads. The deduction, therefore, that the Court had to consider, so far as Leith was concerned, was £8 in respect of feu-duties. The reduction he sought on the valuation of the Assessor for Edinburgh was £7838.

In answer to Lord SALVESEN, Mr. Millar said there was no appearance for the Assessor of Midlothian; and the decision of the Midlothian Valuation Committee stood. Mr. Millar said his contention was that the rule which was laid down in the decision of the Court in 1909 entitled them to a deduction of the whole expenses on the undertaking, whether they were landlords' or tenants' taxes.

Lord JOHNSTON said there might be a distinction between a case in which the owner asked a deduction of feu-duties from a real rental, and one where a deduction of the feu duties or taxes was made on a rental based on calculations such as they had here.

Lord SALVESEN asked what was done with the surplus profit, if any existed.

Mr. MILLAR said the amount required for interest and charges was deducted, and the rate was reduced the following year.

Lord SALVESEN: They apply it in paying interest on capital; and interest on capital is not a deduction.

Mr. MILLAR said the only rule laid down—that of a hypothetical tenant—did not apply here; and the distinction between landlords' and tenants' charges did not apply.

The Hon. W. T. WATSON, for the Assessor, maintained that his friend, in citing Lord Low's opinion in the 1909 appeal, was seeking to make a universal rule out of an anomalous case; but instead of it being in their favour, it was against them. In the judgment, which laid down what his friend called a rule, there was an express approval of the judgment of Lord Trayner in the case of the Assessor of Railways and Canals. The last case, that of 1909, he held, was decided with a certain measure of reluctance, and with certain qualifications, which his friend wished to extend to a rule making the anomaly greater. He further contended that if there was to be a complete ignoring of the existence of the landlord's expenditure, as being present in such an undertaking as this, the Assessor would be entitled to refuse to make a deduction of 5 per cent. for floating capital and tenants' chattels.

Lord JOHNSTON took objection to this course, seeing that Counsel had not asked that the cases should be mutual; but it was understood that the judgment in the Edinburgh case on the question of landlords' taxes would rule that of Leith.

Senior Counsel having spoken, judgment was reserved.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Proprietors was held last Tuesday at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. HENRY BIRCHENOUGH, C.M.G., in the chair.

The SECRETARY (Mr. W. Martin) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

SATISFACTORY BUSINESS OF THE UNION DES GAZ.

The CHAIRMAN, in moving the adoption of the report and accounts, said he would first of all refer to the progress of the Union des Gaz, in which Company they were deeply interested, during the year under review. It would be gathered from the report that the year had been a fairly prosperous one for the Company. There had been an increase in the length of mains, in the number of public lamps, in the number of private consumers, and, as a result, an increase in the sales of gas exceeding 5 per cent. The profits had also increased; so that the Union des Gaz was able to distribute the same dividend as last year—viz., 7½ per cent.—while adding £8000 to the special reserve fund, and carrying forward £15,698, which was £1100 in excess of the carry-forward of last year. During the autumn, he (the Chairman) visited Italy in company with his colleagues, Mr. A. F. Phillips and Colonel Le Roy-Lewis. They made a considerable stay at Milan, and carefully inspected not only the works but the whole position of the Company there. He was pleased to tell the proprietors that they were all three delighted with the high state of efficiency to which the undertaking had been brought under their able and energetic Manager, Mr. Gruss. The works were in excellent order, fully equipped with the best modern machinery, and would now do credit to any gas company in the world. The discipline of the men had improved in a very striking manner. For this, the thanks of the Directors and stockholders are largely due to Mr. A. F. Phillips, and certainly, so far as the staff was concerned, a genuine *esprit de corps* was growing up, which augured well for the future. Contracts had been concluded with a network of important communes to the north of Milan, for which the Company had in great measure to thank the tact and skill of Mr. Gruss. These contracts consolidated the position of the Company on the north side of Milan, and secured to the Union des Gaz a large and progressive district, which could not fail to be of great value in the future.

LABOUR TROUBLES IN MILAN.

It was probably within the knowledge of the proprietors that there was a strike at the Milan works in the month of June. Like so many strikes in these days, it was a strike, not for an increase of wages nor for any amelioration of the conditions of the men, but simply against discipline. It had for its object the restoration of the old organico, and, by this means, to regain the practical control of the discipline and management of the works, which had been fully restored to the Company as the result of the last great strike in 1910. He need hardly tell the proprietors that the Board had resisted this attempt with all their strength. It was due and right to say that the civil power gave the Company complete protection during the period of the strike. Thanks to the measures taken by the Board, and by Mr. Gruss and the engineers on the spot, there was no interruption whatever in the supply of gas to the city or to the consumers. Indeed, it was commonly said in Milan that if it had not been for reading about it in the newspapers, the people of Milan would not have known that there was a strike in progress. At the end of three weeks, the men returned to their duties upon the Company's terms; and they had since settled down to regular and unbroken work. He ventured to hope that there might now be a truce from labour trouble at Milan for some time to come. One of the most hopeful symptoms, he might say, was that, during the strike at Milan, there was no interruption of work at Genoa, or at the two other Italian stations of the Company.

WORKING AT OTHER STATIONS.

Mr. Phillips and Colonel Le Roy-Lewis subsequently visited Genoa, Alessandria, and Modena; and they were able to give a most favourable report upon the condition of the works in these cities. At Genoa, the working has improved in a marked degree under the sustained and able efforts of Mr. Morton and his very efficient Works Managers. Both the Sampierdarena and Gavette works were now fully equipped with the most modern labour-saving machinery, and were in a position to cope with a considerably increased demand for gas.

COST OF LIVING, AND A VOLUNTARY INCREASE IN WAGES.

In view of the account he had given of the labour troubles at Milan during the year, he felt sure it would interest the proprietors to know that the Directors of the Union des Gaz, during their visit to Italy, carefully studied the effect of the increased cost of living upon the condition of their employees. As the proprietors knew, the increased cost of living was general throughout the countries of Europe, and was not confined to Italy. As the result of the inquiries, and also in view of the improved discipline and increased efficiency of the men, the visiting Directors decided to recommend the Board to increase the pay of all the employees of the Company from Dec. 1. This increase had now taken place. He was happy to say that it had been well received, and had had an excellent effect, not only upon the minds of the men themselves, but upon public opinion in Italy, which had been quick to recognize that the Company had voluntarily, and without outside pressure of any kind whatever, given all-round advances of pay when they saw that they were called for by circumstances, and were deserved by the men.

BUSINESS EXPANSION IN OTHER DIRECTIONS.

Of the other principal works of the Company, he had not much to say; but, such as he had, it was entirely favourable. Directors had visited Strasbourg and reported that the condition of the works and the working results had greatly improved under the new and energetic

Manager, Mr. Ruhland. Mr. Gardiner (for whose absence that day through indisposition he must apologize) had lately been to Nanterre, where the business of the Company, in a most important group of Suburban Communes in the neighbourhood of Paris, continued to grow in a remarkable manner. He had reported that the works were all that could be wished, with the exception that they would very soon be too small to supply the needs of so progressive and expanding a district.

CAPITAL EXPENDITURE.

From this brief review, it would be gathered that the works of the Union des Gaz were in a very efficient state, and were ready to cope with increased business. For several years the Directors had had to inform the proprietors of very large capital expenditure upon the part of the Union des Gaz for the renewal and extension of the plant. He thought he might say that the epoch of large capital expenditure was, for a time at all events, he would not say at an end, but suspended, and that the proprietors might now expect to see the expenditure winning its full return. He did not wish for a moment to suggest that the capital account of the Company was closed. The capital account of a supply company was, of course, never closed. With such a company as the Union des Gaz, stagnation would mean retrogression. But in the history of all such companies, there were periods of smaller capital outlay, during which the shareholders might expect to receive the fruits of previous large outlay; and he thought the Union des Gaz was entering upon such a period now. The Directors felt that they might legitimately look forward to the future with cheerfulness. There were one or two clouds on the horizon—he referred to the large advance in freights to the Mediterranean, and to the possibility of higher prices for coal. The financial year was, however, still young; and it was by no means beyond the range of possibility that they might see a welcome improvement after the turn of the calendar year.

THE POSITION AT MESSINA.

Turning now to the affairs of their own Company, the Continental Union, he need hardly tell the proprietors that the chief preoccupation of the Board during the year had been the position of the undertaking at Messina. At the meeting last December, those who were present would remember, he gave a full account of the negotiations with the Royal Commissioner up to December, 1910. At that time, there was reasonable expectation that the Company might obtain some sort of settlement of the town debt without incurring any further responsibility with regard to the lighting of Messina. It was, in fact, upon this basis that Mr. Phillips and Mr. Martin carried on the negotiations in Rome in November, 1910; and the Board were distinctly under the impression that they were in agreement with the Royal Commissioner upon this point. About the date of the last general meeting, however, the Royal Commissioner appeared to have changed his mind; for the Board found themselves again confronted with the position that further negotiations for any settlement of the debt must be accompanied by proposals for a new lighting contract. After careful consideration, and in view of the deadlock they had reached, they came to the conclusion that, reluctant as they were—and they really were extremely reluctant—to undertake any fresh obligations, this might, after all, be the best way out of a bad business, provided that the conditions of the new contract were satisfactory, and provided that it carried with it an equitable settlement of the town debt. Negotiations were accordingly continued upon these lines; and in February of this year a provisional agreement was drawn up between the Royal Commissioner and the Company's representative. Subsequently, modifications in this provisional agreement were asked for by the Royal Commissioner, and were met by the Directors in a conciliatory spirit. On March 31, at the request of the Royal Commissioner, Mr. Phillips went to Rome to bring the discussion to a final issue, and to settle definitely the terms of the new contract. Mr. Phillips had the assistance of Mr. Ricci as legal adviser, and Mr. Morton and Mr. Bickley, of Genoa, as technical assistants. The Royal Commissioner was accompanied by the Secretary and Chief Engineer of the Municipality of Messina. After three days' discussion, an agreement was arrived at with regard to both the settlement of the town debt and the new contract, and was signed by the Royal Commissioner and Mr. Phillips, and also by the gentlemen assisting them. In order to secure this, the Directors made great sacrifices; for it involved the acceptance of 50 per cent. of the town debt in full settlement of their claims. Still, knowing what had taken place with regard to the settlement of other claims upon the town of Messina, and being satisfied that they had secured a good and workable new contract, they felt justified, in the interests of the shareholders, in sanctioning the agreement with the Royal Commissioner. Now he wished to point out that this was a formal agreement with a public functionary; and the Directors had every right to look upon it as a solemn compact, and to believe it would be loyally carried out. What actually took place? The agreement was submitted to the Provincial Council in Sicily as a matter of routine and administrative practice. Instead of being approved—as he believed all other similar arrangements made by the Royal Commissioner had been approved—the Provincial Council formulated a series of fresh demands, partly for modifications in the terms of the gas contract, but most important of all for a serious reduction in the amount the Royal Commissioner had formally and specifically agreed to pay the Company in discharge of the town debt. This reduction the Board refused to accept; basing its refusal upon the signed agreement of the Royal Commissioner. Again, they seemed to have reached a deadlock. However, acting upon the advice of the Company's distinguished Counsel, Mr. Ricci, they had continued the negotiations through the summer. Finally, the Board offered to accept a somewhat less sum than they considered themselves entitled to, provided that the new contract was signed without further dispute or further delay. They gave the Royal Commissioner until Nov. 30 to make up his mind, after which they gave notice that all previous offers must be considered withdrawn, and reserved full liberty of action to take any steps they considered necessary to assert and maintain their legal rights to the uttermost. No reply had so far been received; and it was understood that the Royal Commissioner had referred the whole question back to the Provincial Council for their views. He (the Chairman) had endeavoured, to the best of his ability, to describe as clearly and as impartially as possible the course of the involved negotiations. He hoped the narrative had conveyed to the minds of the proprietors the impression that had been created in their own—that they had been unfairly treated, that written agreements had not been carried out, and that the desire and effort to meet the authorities and people of Messina had not been met in a spirit of justice and fair-dealing. He need not tell the proprietors that the Board would continue their efforts to defend the proprietors' interests; and they might rely upon them using every legal means to secure a settlement of the just claims of the Company. He had hoped up to the last moment to be in a position to make a definite announcement that day with regard to the further position at Messina. If this had been possible, he should have given a forecast of the manner in which the Board proposed to deal with the Messina item in the accounts. As things were, it was not possible, so he would only remind the proprietors that the Directors had continued the policy of the last two years in taking £10,000 from the profits of the year, and carrying them to the Messina amortization account, which now stood at £42,000, and thus reducing the amount standing to the debit of the Messina outlay account to £39,739, which was a rather less sum than stood to the credit of the reserve fund.

THE ACCOUNTS.

He would now deal briefly with the accounts of the year. Looking at the general revenue account, it would be seen there was nothing on the left-hand side which called for comment. The items varied little from those of last year. Management general charges were a little less and pensions a little more. On the right-hand side, there was a reduction of £425 in the amount of the Union des Gaz dividends. This was mainly due to the sale of 158 Union des Gaz shares since the issue of the last balance-sheet. On the other hand, there was an increase of nearly £1000 in the earnings from other investments. The final result was that they carried this year to net revenue account £54,459, against £54,012 last year—an increase of £447. Turning to the balance-sheet, the only points to which he had to call attention were the reduction by about £4700 in the holding in the Union des Gaz, and an increase of about £15,000 in the sundry investments and cash at bankers taken together. He had already said that they were carrying £54,459 to net revenue account. If they added to this the balance of £11,783 brought forward from June, 1910, it would be seen that the total amount of undivided profits the Directors had to deal with was £66,242. They would ask the proprietors to approve passing £10,000 of this amount to the Messina amortization fund, and to agree to a dividend of 4 per cent. for the year, free of income-tax, upon the ordinary shares of the Company, which would leave £11,059 to carry forward to next year.

The DEPUTY-CHAIRMAN (Mr. Arthur Lucas) seconded the motion.

The CHAIRMAN, replying to inquiries by Mr. Cave Orme, Mr. E. A. Goulding, M.P., Mr. H. C. Davenport, Mr. J. F. Remnant, Mr. R. Stevens, and others, gave further information as to the position at Messina, and explained additional items in the accounts. As a result of the discussion, he promised that, as soon as a definite position was reached in regard to Messina, the Board would issue a circular to the shareholders as to the result of the now pending negotiations.

The motion was adopted *nem. con.*

Moved by the CHAIRMAN, and seconded by Mr. A. F. PHILLIPS, a dividend at the rate of 7 per cent. on the preference stock, less income-tax, and of 4 per cent. on the ordinary stock, free of income-tax, was declared.

On the proposition of the CHAIRMAN, seconded by Mr. N. E. B. GAREY, Mr. Arthur Lucas and Mr. A. F. Phillips, the Directors retiring, were unanimously re-elected.

The Auditors (Mr. A. T. Eastman and Mr. C. F. Crookenden, F.C.A.) were also re-appointed, on the motion of Mr. REMNANT, seconded by Mr. LEONARD WILKINSON.

COL. H. LE ROY-LEWIS, D.S.O., proposed that the best thanks of the proprietors be given to the Secretaries, Managers, Engineers, and staff of the Company and of the Union des Gaz, both in London and abroad. In the course of his remarks, he said he had travelled round to the whole of the stations twice since his election as a Director; and so he had been able to convince himself as to the earnest and conscientious men they had looking after the business of the two concerns on the Continent. He particularly mentioned the Manager of the Union des Gaz at Milan, and the Secretary in Paris, as well as Mr. Martin in London. The engineers at all the stations were devoted officers.

Mr. PHILLIPS seconded the motion, which was heartily passed.

Mr. GOULDING proposed, and Mr. CAVE ORME seconded, a cordial vote of thanks to the Chairman and Directors.

The CHAIRMAN, having acknowledged the vote, asked the Deputy-Chairman to say a few words.

Mr. LUCAS complied, and remarked that he wished the proprietors to go from the meeting with the fixed idea that the Board were doing their very best when dealing with the abnormal state of affairs that had followed the sweeping away of Messina by the earthquake. The Italian Government were doing what they could to reconstruct the city; and, of course, they wanted to do their best, according to their lights, for the interests of the city. The Board were very disappointed that they had not yet arrived at a fixed result; but he believed that they would soon do so. However, as the Chairman had said, the belief of the Board was that, so far as this particular business was concerned, they would shortly be able to send out a circular to the shareholders, informing them as to the result. The gas business was prospering; and he had every hope and belief that there was a bright future for the Company.

This concluded the proceedings.

Wakefield Corporation and the Gas-Works.—A member proposed at last week's meeting of the Wakefield Corporation that the standing orders be suspended in order that the question of the purchase of the gas-works might be considered. It was pointed out by him that this was a favourable opportunity, seeing that the Company were promoting a Bill in Parliament. The Mayor, however, said he thought the matter was not urgent; and it was left over for consideration by the General Purposes Committee.

THE BURKHEISER PROCESS OF GAS PURIFICATION.

Report of a Sub-Committee of the Glasgow Gas Committee.

In accordance with a minute of the Gas Committee of the Glasgow Corporation of the 25th of August last, the Convener (Mr. Thomas Paxton), Sub-Convener (Mr. Robert Kirkland), and the Gas Engineer and Manager (Mr. Alex. Wilson) inspected and reported upon various systems of high-pressure gas lighting; and, in addition, they presented a report on the Burkheiser process of gas purification. As this report was intended specially for the use of members of the Council, it was deemed advisable to devote the first portion of it to a description of the methods at present in use for the purification of gas. This having been given, the Burkheiser process was described; and this portion of the report will be found in another part of the "JOURNAL." It will be seen therefrom that the Sub-Committee recommended that it is not advisable for the Corporation to instal any of the Burkheiser plants until further experience has been gained; and that all information available regarding further tests of the process should be obtained, as it is probable it will have much influence on the gas purification of the near future. The report was submitted to the Gas Committee last week, and was approved.

LIMITATION OF CORPORATION GAS PROFITS.

Salford Town Council and the Action of the Out-Districts.

Much of the time at last Wednesday's meeting of the Salford Town Council was taken up discussing the position of the Corporation and the local authorities included in the Salford Corporation gas supply area in regard to the Parliamentary Bills of which notice has been given. Soon after the commencement of the meeting, Councillor Purcell asked the Chairman of the Gas Committee (Alderman Phillips) if his attention had been called to a statement by Mr. Scott Forbes, Mayor of Eccles, to the effect that a promise made by the Salford Corporation Gas Committee, to submit to the outside districts a proposal with reference to the gas supply, had not been carried out.

Replying, Alderman Phillips said that an informal conference took place, and the matter was discussed without prejudice and on the distinct understanding that nothing as to what took place should be published. Therefore, he did not feel justified in stating publicly what transpired at the meeting. Asked again by Councillor Purcell if the Salford Gas Committee did not promise to submit their proposals in writing to the outside authorities, Alderman Phillips said that the latter did suggest that the proposals might be submitted to them in writing; but he did not promise to do so. What he said was that it would be taken into consideration. In reply to Councillor Wheatcroft, the Town Clerk said that the conference of representatives of corporations having gas undertakings, held in London recently [*ante* p. 704] to consider the question of the limitation of gas profits, was called on the authority of the Gas Committee of the Salford Corporation. The conference was ratified by the Parliamentary Committee, who were represented at it; the idea being that if a principle were to be enunciated which would affect all authorities engaged in municipal trading, it was only fair and proper that they should be consulted. No action had been, or would be, taken which would in any way commit Salford without the authority of the Council. The conference was a consultation and nothing more.

The subject was revived later on when Councillor Bescoby moved the adoption of a resolution for the appointment of a Special Committee to meet the representatives of the out-districts in conference, to discuss the gas question with a view to arriving at a satisfactory basis of agreement. The out-districts were willing and anxious to meet the Salford Council with regard to the percentage of profit the Corporation should receive on the gas undertaking. In his opinion, if a friendly conference was held, good would come out of it. Now was the time to act and endeavour to allay the feeling of irritation which had existed between the Salford Council and the outside authorities for so many years, and which had cost them a lot of money. Since 1891, Salford and the out-districts had spent £35,000 in litigation. The Corporation had lost in previous battles at Westminster, and had had to pay; and if they went to Westminster again over this latest dispute, as they proposed to do, and lost once more, it would cost them £10,000.

The Mayor (Alderman Lindley) pointed out that the Parliamentary Committee had appointed a strong Sub-Committee to deal with the question; and if there was a chance of opening up negotiations with the out-districts, it was certain to be taken advantage of. Therefore, he thought the discussion in the Council Chamber might be dropped. Councillor Bescoby wanted a definite answer as to whether they were going to insist on 2 or 2½ per cent. profit on the whole capital or on the unredeemed capital, which the out-districts were prepared to discuss. The Mayor suggested that Councillor Bescoby should not press the point. Alderman Huddart would not admit that the out-districts had a grievance. Salford had invested a million of money in the gas undertaking, and the out-districts had not speculated a penny. The whole principle of municipal trading was at stake; and it was certain that if they lost on this point in regard to the gas-works, it would not end there. This was why the representatives of other municipalities had been in conference with Salford; and he believed an effort would ultimately be made to put an end to the iniquitous decision of Lord Donoughmore's Committee two years ago on this matter of the limitation of profits.

After some further discussion, the resolution was put and declared to have been defeated by 30 votes to 7.

A Thirty Years' Dispute.

At the meeting of the Eccles Town Council, it was decided unanimously to promote a Bill in Parliament next session with the main object of limiting the profits made by the Salford Corporation on their gas undertaking. Mr. Scott Forbes, the Mayor, who proposed the resolution, said this dispute with Salford had been going on, more or less, for over thirty years; and on every occasion when Salford had promoted a Bill in Parliament containing gas clauses, one or other of the authorities within their area of supply had petitioned against the measure—the idea all along being to bring about a limitation of the profits on the gas undertaking which were handed over in relief of the rates of the borough. On the last occasion—that was, in 1909—a Parliamentary Committee, of which Lord Donoughmore was the Chairman, decided that 1 per cent. on the capital outstanding was a fair profit. As the amount of such capital was then £562,005, this would have meant £5620; whereas the profits applied by Salford to the reduction of rates had averaged approximately £29,000. Notwithstanding this decision of Lord Donoughmore's Committee, Salford had further increased the price of gas 2d. per 1000 cubic feet, and had also attempted to re-introduce meter-rent charges. Salford, though giving notice of Bills in 1910 and 1911, did not proceed with them, and now the out-districts had taken action. Eccles and the other townships had suffered by being compelled to pay more for their gas than the Parliamentary Committee thought fair; and he contended that in this matter they were fighting the battle of Salford gas consumers as well as those in the out-districts.

Salford Ex-Mayor's Views.

Alderman Snape, an ex-Mayor of Salford and a member of the Gas Committee, when seen in reference to the matter said: The gas-works are primarily for the inhabitants of the Municipality, and the question is whether the Corporation Gas Committee should manufacture gas at cost price and take all the risks of loss, which might be serious, and which would have to be borne by all the inhabitants of the borough, or whether, the matter being a purely trading one, they should make a profit like any gas company. For instance, in Liverpool the gas is supplied by a Company; and they devote a profit of, I believe, some 10 per cent. annually in the shape of dividend to their shareholders. In that case, of course, only those who use gas have to pay. In the one case you have the Company supplying gas—finding all the money and taking all the risk—and in the other you have the Municipality supplying gas at cost price and making all the ratepayers, including those who do not use gas, responsible for any loss that may ensue. Again, a company making a profit makes it out of every consumer, and does not Salford stand in the same position towards the outside districts to whom it supplies gas? Is it not right that a corporation or a company should have a profit on its trading transactions? Personally, as a member of the Salford Corporation Gas Committee, I am prepared to give my time to seeing that gas is manufactured for the ratepayers of Salford; but I am not prepared to give my time to manufacturing gas for the ratepayers in the out-districts unless the Corporation of Salford, whom I work for, get a profit. This appears to me to be the whole question. But a further question arises. The Liverpool Gas Company have divided their profits year by year among the shareholders. Salford has used its profits in paying off loans, and has thus accumulated capital of £350,000 or thereabouts. The Liverpool Company's profits have gone, and cannot be got back. The Salford profits have been used partly in relief of rates and partly in payment of loans. So that our gas-works are now worth, in round figures, a million of money. Our loans are about £630,000; and I hold that the difference between the two is capital belonging to the Salford ratepayers, and that they are entitled to a profit on this capital in the same way as I am when I save my dividends for a period of years and invest them in additional shares. This is the real matter between Salford and the out-districts; and as the out-districts have declined to meet representatives of the Salford Corporation in friendly conference, nothing remains but to thresh it out at Westminster, where we hope for a reasonable and judicial decision.

The Main Point in the Dispute.

Mr. W. T. Postlethwaite, the Clerk to the Swinton and Pendlebury Urban District Council, on being interviewed, denied that the out-districts had declined to meet the representatives of the Salford Corporation in friendly conference. Three months ago, in response to a communication received from Alderman Phillips, the Chairman of the Salford Gas Committee and then Mayor of the borough, a conference was arranged between representatives of the out-districts and the Salford Corporation. This conference took place at the Salford Town Hall, and Alderman Snape was present. When we arrived at Salford, we were asked what we were willing to take instead of Lord Donoughmore's decision. Our reply was that, having obtained a decision of a Committee of the House of Lords, we considered that the onus of offering an alternative lay with the Salford representatives. After considerable discussion, Alderman Phillips promised to lay the matter before the Gas Committee, and to let us have the proposals of Salford. From that moment no offer has ever been made by the Salford Corporation. We are waiting to see what Salford has to offer. If no offer is made, the out-districts' Parliamentary Bill will be pressed to give effect to the finding of Lord Donoughmore's Committee in 1909. The main point of the finding was that the profits to be carried to the relief of rates should be limited to 1 per cent. of the outstanding capital. If applied, this decision would substantially reduce the sum now handed over to the relief of Salford rates, and enable the Corporation to give the consumers in the out-districts much cheaper gas than at present.

At their meeting last Wednesday, the Gas and Electricity Committee of the Rochdale Corporation had under consideration a communication from the Salford Corporation on the question of the limitation of profits, raised by the Bill which is being promoted jointly by the Corporation of Eccles and the Urban District Councils of Swinton and Pendlebury and Worsley. The matter having been considered fully, the Committee decided to recommend the Council not to take any action; and this decision was confirmed by the Council next day.

Water Supplies in Morocco.—The Committee of Public Works of Morocco have announced among their contemplated projects the provision of water-supply plant for Tangier and Casablanca; and tenders will be invited as soon as the specifications are complete. The cost of the entire plant is expected to amount to £60,000 or £80,000.

HOLBORN PUBLIC LIGHTING SCHEME.

London County Council Sanction the Raising of the Money.

At the Meeting of the London County Council last Tuesday—Mr. EDWARD WHITE, J.P. (Chairman), presiding—the application of the Holborn Borough Council for sanction to the borrowing of £8000 for carrying out an improved scheme of public lighting, details of which have already appeared in the columns of the "JOURNAL," was under consideration.

The Finance Committee presented a report in which they stated that they had considered an application from the Holborn Borough Council for sanction to the borrowing of £8000, repayable within ten years, for street lighting. The Council proposed to accept a joint tender of the Gaslight and Coke Company and the Metropolitan Electric Supply Company for lighting the public thoroughfares, partly by gas and partly by electricity, for a period of ten years. For an annual payment of £7645, the Contractors undertook, in addition to supplying the gas and electric current required, with attendance, to provide the necessary new lamps, columns, and fittings, which would become the property of the Borough Council. They would not, therefore, require a loan; but, as the capital expenditure involved was to be spread over a period of ten years, the arrangement was regarded by the District Auditor as being in the nature of a loan requiring the County Council's sanction. The Borough Council therefore applied for authority to borrow the amount named, as representing the capital expenditure to be incurred. The Committee said they were advised that the amount was reasonable, and that there was no objection to the period of repayment proposed, having regard to the probable life of the works. They therefore recommended that the necessary sanction should be given; the amount borrowed to be repaid by yearly, half-yearly, or quarterly instalments of principal, or of principal and interest combined, of as nearly equal amounts as practicable, within ten years from the date of borrowing.

Mr. J. D. GILBERT moved that the recommendation be referred back to the Committee. He said the Borough Council proposed to accept a joint tender of the Gas and Electric Supply Companies for lighting the public thoroughfares, partly by gas and partly by electricity, for a period of ten years. For an annual payment of £7645, the Contractors undertook, in addition to supplying the gas and the electric current required, to provide the necessary new lamps, columns, and fittings, which would become the property of the Borough Council. His reason for moving the reference back was to enable the Chairman of the Committee to give the Council further information or else bring up another report. He believed it was quite unusual for gas companies and electric light companies to join hands in the manner shown. It was proposed to pay in ten years £7645 annually for lighting the public streets; and out of this amount a certain number of gas and electric fittings and standards were to be supplied. There was not the slightest information in the report as to how many standards were to become the property of the Borough Council, and what standards existed in the streets. He would have expected the Finance Committee to be extremely severe on the Borough Council entering into an agreement with two Companies for ten years for the purpose of street lighting. The usual thing for a Borough Council in London to-day was to enter into an agreement for street lighting for a period of three years. Everybody who knew the varying price of gas and electricity in London must admit that an extremely bad bargain had been made. He thought the Committee might have pointed out the great difference in the price for gas in the centre and the other parts of London, and the extra cost which the central parts of London, particularly Holborn, were paying for street lighting as compared with some of the boroughs on the outside limits; and the Committee should have brought to the attention of the Borough Council the question of whether they were within their rights in entering into an agreement to pay to the Gaslight and Coke Company the extra amount charged for gas in North London as against the price in South London. In South London, the Gaslight and Coke Company, who had to compete with the South Metropolitan Gas Company, charged 2s. 2d. per 1000 cubic feet; whereas in North London they charged 2s. 9d. He presumed Holborn would come under the higher charge; and he urged that the Council should be supplied with further information as to what liability Holborn was really incurring by the proposed arrangement.

Mr. E. SMITH said he seconded the motion for the purpose of obtaining information which was not given either in the report or in the recommendation.

Mr. R. C. NORMAN (Vice-Chairman of the Finance Committee) said it had not been customary to give the kind of details suggested in reports in regard to loans which came before the Finance Committee. An arrangement of this kind had been made on a good many occasions, and the present was not quite a unique recommendation. It came before them merely because, in the opinion of the District Auditor, the transaction was in the nature of a loan, and therefore it required the sanction of the Council. The Borough Council had entered into an arrangement for a period of ten years. There were, of course, two payments involved—one a capital payment necessary for alterations to lamps and other things (and he might inform Mr. Gilbert that there were 1822 standards), and the other in the nature of a maintenance charge. In an ordinary case, the loan would be sanctioned by the Council, or the money obtained elsewhere; and the repayment would be spread over a period of years, and the debt charges, together with the payment for the light, would be a charge falling on the Borough Council's rates. Instead of this, the Borough Council had now entered into an agreement with the two Companies, who were the lending Companies, for the new capital expenditure, and the borough would repay this to the Companies over the period for which the agreement lasted—viz., ten years. The capital sum involved was £8000. The £7645 was the payment for light together with what really was, in substance, the debt charges on the £8000. The amount paid by the borough in 1909-10 for public lighting was given as £7102 for 148,000-candle power; but for the additional payment of £543 per annum the light would be trebled.

Mr. L. W. S. ROSTRON said he wished to correct a statement made by Mr. Gilbert (no doubt unwittingly) which was not altogether fair to the Gaslight and Coke Company—that the Company charged one price in North and another in South London, owing to their being on the South in competition with the South Metropolitan Gas Company. As a matter of fact, they had to charge the price named in South London under an Act of Parliament. There was no place in London where there was competition between two gas companies.

Mr. R. I. TASKER said the only question was whether the Borough Council were wise in spreading the expenditure over ten years, or whether a three-years agreement should have been entered into; and he submitted that no case had been made out why the County Council should not agree to the proposal.

Alderman A. F. BUXTON said the Borough Council had a right to light their streets as they pleased, and the County Council had been informed that the bargain was a fair one. It was not their business to go into the matter further.

On a show of hands, the motion to refer the report back was lost by 30 votes to 19. A division was claimed, but disallowed by the Chairman; and the Committee's recommendation was then agreed to.

RATES AND GAS, ELECTRICITY, AND WATER CHARGES.

Mr. James Carter's Annual Return.

We have received from Mr. James Carter, the Borough Treasurer of Preston, a copy of his tabulated statistics of rates levied, together with charges made for gas, electricity, and water, and profits and losses on municipal undertakings in a number of Provincial towns and a few Metropolitan boroughs, for the year 1911-12. There are in all ninety-five places referred to, which is one more than in the previous compilation; the addition being Wallasey. The populations range from 746,566 (Liverpool) down to 20,205 (King's Lynn).

The rateable values are highest in Westminster (£6,564,108), Liverpool (£4,783,340), Manchester (£4,554,958), Kensington (£2,419,344), and Leeds (£2,127,169), and lowest in King's Lynn (£86,370), Bacup (£87,257), Brighouse (£89,764), and Stafford (£93,554). The places most heavily rated are: Norwich, 10s. 8d. in the pound; East Ham, 10s. 1d.; West Ham, 9s. 11d.; Halifax, 9s. 6d.; Leeds, 9s. 4d.; Wigan (old area), 9s. 3d.; Wolverhampton, 9s. 3d.; Rotherham, 9s. 2d.; Sheffield, 9s. 1½d.; Batley, 9s.; Brighouse, 9s.; Middlesbrough, 9s.; and Preston, 9s. Those which have the lightest rates are: Oxford, 4s. 8d. in the pound; Blackpool, 5s., and Bournemouth, 5s.

Out of the rents of property and profits transferred from municipal undertakings, the rates are reduced in the following towns to the extent of 1s. or more in the pound: Macclesfield, 1s. 10d.; Warrington, 1s. 7½d.; Stafford, 1s. 4¾d.; Darlington, 1s. 4½d.; Stockport, 1s. 4½d.; Nottingham, 1s. 3¾d.; Wallasey, 1s. 3¾d.; Bolton, 1s. 3d. (water profits to reserve fund); Burnley, 1s. 3d.; Dewsbury, 1s. 2½d.; Leicester, 1s. 2½d. (water, electric light, and tramway profits to reserve fund); Carlisle, 1s. 0¾d.; Salford, 1s. 0¾d.; and Lancaster, 1s. 0¾d. On the other hand, very small profits in aid of the rates were contributed by Bootle, 1d. in the pound; Eastbourne, ¾d. (electric light and tramway profits to reserve fund); Sunderland, ¾d.; Hampstead, ½d.; West Hartlepool, ½d.; Leamington, ¼d.; and Middlesbrough, ¼d. (gas and electric light profits to reserve fund). Out of the total of ninety-five places included in the list, thirteen made no profit for the reduction of the rates; and a separate table gives forty-three instances in which the rates have been increased in consequence of losses on one or more undertakings which were probably in most instances intended to be remunerative. The largest individual loss chronicled has arisen in connection with docks at Bristol (£124,669) and Preston (£34,500) and water-works at Swansea (£35,637); while gas does not appear at all in this particular part of the return. Water losses at Bacup were responsible for an addition of 1s. 10d. in the pound to the rates, and at Swansea of 1s. 7d. Electric light losses were incurred at Bath, Hastings, Heywood, and Wakefield.

Turning to the table giving the charges for gas and water, it is found that the price of gas for domestic lighting supplies is again highest at King's Lynn—3s. 6d. per 1000 cubic feet; while it is once more lowest at Widnes, at 1s. 1d. per 1000 cubic feet—with, of course, an even lower rate for large consumers, engines, &c. The following towns also possess the advantage of a gas supply for domestic lighting at 2s. or less per 1000 cubic feet: Sheffield, 1s. 3d.; Plymouth, 1s. 7d.; Belfast, 1s. 9½d.; Bath, 1s. 10d.; Bury, 1s. 11d.; Gloucester, 1s. 11d.; Huddersfield, 1s. 11d.; Lancaster, 1s. 11d.; Oldham, 1s. 11d.; Sunderland, 1s. 11d.; Gateshead, 1s. 11½d.; Newcastle, 1s. 11½d.; Bradford, 1s. 11¾d.; Burnley, 1s. 11¾d.; Bristol, 2s.; Cheltenham, 2s.; Darlington, 2s.; Halifax, 2s.; Lincoln, 2s.; Tynemouth, 2s.; and Wallasey, 2s. The charge per B.T.U. for domestic lighting supplies of electricity ranges from 6½d. at Bournemouth and 6d. at Oxford to 2¾d. at Bury, and 3d. at Ashton-under-Lyne, Burnley (flat rate), Stalybridge, and West Ham (flat rate). The charge for water for domestic purposes on a house of £15 rateable value is highest in Lincoln—at 2s. 4d. in the pound (within the city limits). It is lowest in the following towns: King's Lynn, 7d.; Liverpool (within the city limits), 7½d.; Southampton, 8d.; Brighton, 9d.; Leamington, 9d.; and Manchester, 9d. The other places in which the charges are less than 1s. are: Bournemouth, Gloucester, Oxford, Plymouth, Reading, Widnes, and York. At Preston (Mr. Carter's own town), the rates are 9s. in the pound; and they are relieved to the extent of 7d. by the profits transferred from reproductive undertakings. On the other hand, however, there is the deficiency on the docks which, it is stated, increases the rates by 1s. 8d. in the pound. The price of gas at Preston for domestic lighting is 2s. 8½d. per 1000 cubic feet; of electricity, 4½d. per unit (flat rate); and of water, 1s. 2d. in the pound on £15 houses.

There is a table showing the amount estimated for the current year to be transferred to the borough, district, or other fund from the various profitable undertakings.

PRESENTATION TO MR. JAMES BRADDOCK.

The employees of the Radcliffe and Pilkington Gas Company have made a presentation to Mr. James Braddock, the Engineer and Secretary, as a mark of their esteem on his completing thirty years' service with the undertaking. Quite recently the Directors of the Company gave Mr. Braddock a handsome token of their appreciation of his services to celebrate the same event. The workmen's presentation, which took the form of a smoker's cabinet, was made at a tea and social gathering held last Thursday evening in St. Thomas's School, Radcliffe. Mr. John Howarth, the Cashier to the Company, who presided, said Mr. Braddock had striven hard to make the undertaking a success, and had done so with distinction. By his thoroughness, straightforwardness, impartiality, and kindness, he had endeared himself to all with whom he had been associated. There had been many changes in the manufacture of gas since Mr. Braddock first took command of the works; but he had kept abreast of the times, and today the works would compare favourably with those of any gas undertaking in the country. Acknowledging the gift, which was presented on behalf of the subscribers by Mr. George Dawson, one of the oldest employees at the works, Mr. Braddock referred at some length to the changes which had occurred in connection with the undertaking during his thirty years' service. He dealt particularly with the improvements effected in the production of gas, and the great strides which had been made in methods of administration and distribution; and the expansion of the business of the Company. There had, he said, been a reduction in the price of gas from 4s. 9d. net (5s. less 5 per cent. discount) to 2s. 9d. net; other concessions in the case of gas supplied for manufacturing purposes bringing the price to 2s. 1d. He predicted that as gas had progressed in the past, so it would do in the future. The gas industry would not rest, but would continue to prosper and develop. A vote of thanks was passed to Mr. Braddock and his son, Mr. R. B. Braddock, for having entertained the company; and the compliment was acknowledged by the latter.

GAS-FURNACE WORK.

The "Engineering Correspondent" of the "Daily Telegraph" published an article yesterday dealing with the subject of industrial gas-heating. He referred to the adoption of town-gas furnaces at the Royal Mint, upon which an article appeared in our columns on Nov. 28, (p. 606). Proceeding, he said:

As an indication of the load which can be cultivated [by industrial gas heating], we may mention some remarkable figures, kindly supplied by Mr. Thornton, whose firm have during the last five years been responsible for developing the Richmond furnaces used at the leading London bullion refineries. [These establishments were very enterprising, and used gas before the Royal Mint.] Three of the refiners have about 26 large crucible furnaces, which will consume in the aggregate about 25,000,000 cubic feet of gas per annum. That is the sort of load for the gas-works. At the new buildings of the Royal School of Mines, there are fifteen muffle furnaces of the regenerator type for cupellation, ignition, and scorification. Assuming 150 days in the working year, at five hours' working per day, this means over 1¾ million cubic feet of gas per annum—probably over 2 millions in actual practice. Visitors to this school should certainly take an opportunity to see these furnaces; and metallurgists should also carefully inspect them. At Sheffield, the centre of the steel-making industry, the gas is sold on a sliding-scale, from 1s. 2d. down to 11d. per 1000 cubic feet, and the calorific value is said to be 600 B.Th.U. In the furnaces at the works of some of the leading steel makers, carbon steel can be annealed, at an average figure, for 4s. 6d. per ton. The high-speed steel costs for annealing about 6s. a ton, in bar. These furnaces are worked without any blast, and have the great advantage of lower prime cost, easier regulation, and the possibility of creating a reducing atmosphere. The gas consumption in the furnace—all burners on—is about 2000 cubic feet per hour. This furnace takes steel in bar, and is roughly 16 feet long, and has an internal section of 2 feet by 1 feet. In the growing industry connected with small tools, gas-furnaces are rapidly coming to the front; but only the fringe of the industry has yet been touched. All over the Midland and Northern districts, there are many manufacturers annealing with coal-ovens. On account of the better-class work obtainable and the superior results with gas annealing, the local gas supply companies should take the facts into consideration, and use every effort to bring this modern method to the notice of manufacturers.

[Other parts of the article, which extended to a column, are commented upon in earlier pages of this week's issue.]

COKE AND GAS MANUFACTURE IN BELGIUM.

In order to meet the growing home demand for coke for metallurgical purposes, considerable improvements have been decided upon or carried out in connection with the installation of new coke-oven plants, which it is estimated will increase the production to the extent of about 900,000 tons. The following particulars appeared in the Engineering Supplement to "The Times" last Wednesday.

At Sluiskill, near Terneuzen, a battery of 160 coke-ovens on the Coppée system is contemplated for the supply of five companies working blast-furnaces in the Longwy district. At Montigny-sur-Sambre (Charleroi district), it has been decided to construct 80 ovens on the Koppers system; while the Société Athus-Grivegnée will complete their programme of improvements by erecting a new battery of coke-ovens. Installations are also expected at Ostend, Antwerp, Vilvorde, Ghent, and elsewhere, which in some cases are intended for the production of coke-oven gas for light and power conjointly with the manufacture of coke.

The authorities of Ostend recently decided, instead of reconstructing their gas-works, to demolish them, and to invite tenders for the supply of gas obtained as a bye-product from coke-ovens to be erected by contractors on a piece of land which would be let by the authorities at a small rental. [Particulars of the project have been given in the "JOURNAL."] The quantity to be supplied is estimated at 5 million cubic metres (176½ million cubic feet) every year, and it is to be delivered at a fixed rate; the Municipality undertaking only the distribution to the consumers. The contract was recently awarded; and out of the six tenders submitted the most favourable was that of the Compagnie d'Eclairage de la Flandre, which proposed a price of 3·95 c. per cubic metre.

As the concession granted to a company for the supply of gas to the town of Verviers lately came to an end, the Société Ougree-Marihaye submitted to the authorities a proposal for the supply of coke-oven gas at the rate of 5 c. per cubic metre, or 4 c. for quantities in excess of 5 million cubic metres; the charges for distribution and administration, estimated at 2 per cent., not being included. Negotiations are also in progress with the object of supplying gas-works in the Mons district with the gases obtained from coke-ovens.

THE INQUIRY-CIRCULAR NUISANCE AGAIN.

Some Questions by a Water Engineer.

A correspondent has forwarded a letter he received a short time ago from a water engineer, inquiring if he has any deep-well or borehole pumps under his control; and, if so, whether he will be kind enough to answer the questions set out upon an accompanying form. He explains that the returns are not for publication; but he says he will send them to our correspondent if he would like to see them. He apologizes for giving so much trouble, and expresses the hope that he will be "able to reciprocate." As this is a revival of the inquiry-circular nuisance, it may be of interest to our readers to reproduce the questions to which answers were required. They are as follows:

1.—Type of engine used.
2.—Does the engine which actuates the deep-well or borehole pumps also force the water through a rising main—that is to say, have you a surface pumping-engine as well as a deep-well or borehole pumping engine?
3.—Distance from engine-house floor to pumps in well or borehole.
4.—Length of rising main from engine-house to reservoir.
5.—Diameter of rising main.
6.—Are any branch mains or services connected direct to the rising main; if so, could you give particulars?
7.—Height of top water-line of reservoir above engine-house floor.
8.—Indicated or other horse-power of engine.
9.—Total head, including static and frictional, on the pumps.
10.—What is the type of pump used?
11.—Can you give me any particulars of slip of pumps?
12.—Capacity of pumps or plant.
13.—Duty in steam per horse power per hour.
14.—Weight of coal per million gallons pumped.
15.—Cost per million gallons pumped (fuel only).
16.—Are you satisfied with the type of plant in use?
17.—Name of makers of plant.
18.—Any other particulars.
19.—Name of town.

CO-OPERATIVE LOCAL ADVERTISING.

The Barnet District Gas and Water Company and the North Middlesex Gas Company have joined hands in issuing, in the local newspapers, a series of advertisements of a particularly attractive form. One of the series which strikes us as a happy topical hit is an advertisement headed "Insurance Bill"—a subject in which practically all persons in the country concerned in any way in employment are taking interest. The advertisement is as follows:

INSURANCE BILL.

WHAT THE SERVANT SAYS.

I WILL NOT PAY THE TAX. What I do want if I stay in my present place is A MORE COMFORTABLE KITCHEN AND LESS WORK. I WANT A GAS-COOKER, A GEYSER FOR HOT WATER, AND GAS-FIRES. THEY SAVE LABOUR.

ADVICE TO MISTRESSES.

To save dirt, smoke, and dust, and to be independent of dictatorial servants, INSTAL LABOUR-SAVING GAS APPLIANCES.

BARNET DISTRICT GAS AND WATER COMPANY,
Station Road, New Barnet;

NORTH MIDDLESEX GAS COMPANY,
The Broadway, Church End, Finchley.
11, Church Road, Hendon.

This particular advertisement is 8 in. deep by 5 in. wide.

GAS CHARGES IN MANCHESTER.

Possible Reduction Next Year and Introduction of a Sliding-Scale.

The discussion at last Wednesday's meeting of the Manchester City Council as to the price of gas was brief, due to the assurance given by the Chairman of the Gas Committee (Mr. W. Kay) that they were very carefully considering a large scheme for a rearrangement of charges, with a view to making substantial reductions all round in the next financial year. Mr. Hoyle had a motion before the Council that the Gas Committee should be instructed to consider the advisability of reducing the price to all consumers who are at present charged at a higher rate than 1s. 9d. per 1000 cubic feet. Referring in particular to this proposal, Mr. Kay said that he could not promise anything so sweeping as this; but the Gas Committee hoped to put before the Council in the beginning of next year an all-round reduction in price and a sliding-scale which would be to the advantage of every consumer. Mr. Hoyle said he did not mean by his motion that the price to all consumers should be reduced to 1s. 9d., but that there should be a reduction to all who paid more than this at present. In view of the statement made by the Chairman of the Gas Committee, Mr. Hoyle withdrew his motion.

In the course of an interview on the subject of the gas charges, Mr. Kay said he and his colleagues were most anxious to bring about a reduction in price, and introduce some system which would include a sliding-scale of charges and a discount on payments. He also pointed out that comparisons of the prices and profits of gas undertakings in Manchester and other towns, published in some of the local newspapers, were incomplete, and not a true reflex of the actual situation. Manchester, for instance, unlike most other places, made concessions in the way of free meters, cookers, and grillers. In estimating the reduction made in the rates out of gas profits, it was also necessary to take into consideration the question of proportion to rateable value Mr. Kay contends that these and a number of other local circumstances make the comparisons that have been made unfair to Manchester.

Mr. Hoyle, explaining what he meant by his resolution, said he aimed at obtaining a substantial reduction in price to the poorer gas consumers, to apply to the city area only. His idea is that the price could very well be brought down to 2s. per 1000 cubic feet. "I do not think," he added, "this would mean the loss of the grant in aid of rates, if economy was used in connection with the undertaking. I should like people who use prepayment meters to have gas at 2s. 1d., which would mean 40 cubic feet for 1d., instead of 33 cubic feet as at present. There are many ways in which economies might be effected. If the gas were properly purified before distribution, it would save a lot of expense in cleansing out gas-mains, &c. Then with regard to the free use of cookers and stoves, in many houses they are not used for the purposes for which they are supplied, but are left either lying idle or used as meat safes and cupboards. If there were a small hire charge for such apparatus, the people would refuse to keep them when not in use, and a saving might be so effected."

CARLISLE BOUNDARIES EXTENSION SCHEME.

Position of the Gas and Water Undertakings.

Major C. E. Norton, R.E., one of the Inspectors of the Local Government Board, was recently engaged for four days in conducting an inquiry into an application made to the Board by the Carlisle Corporation for a Provisional Order to authorize an extension of the boundaries of the city, so as to embrace Stanwix, Botcherby, Upperby, Harraby, Belle, and other places. In the course of the statement made by the Town Clerk (Mr. A. H. Collingwood) in support of the application, he submitted the following particulars in regard to the gas and water undertakings of the Corporation.

The gas-works were established in 1819 by a Company, and were acquired by the Corporation in 1850 at a cost of £18,000. The plant was capable of furnishing 2,300,000 cubic feet of gas per day. The maximum quantity of gas delivered in any day in 1910 was 1,589,000 cubic feet, on the 3rd of December. There was also at Boustead's Grassing plant for the manufacture of sulphuric acid and sulphate of ammonia. The districts proposed to be included were within the limits of the supply of gas, and most parts were being supplied for public and private lighting. Mains had been laid down, and were the property of the Corporation. The price of gas when the works were acquired by the Corporation was 5s. per 1000 cubic feet. It was now 2s. 3d. within the city. In the districts proposed to be included, the price varied considerably—from 2s. 7d. to 3s. 6d. and 4s. In the event of the proposals of the Corporation being carried through, one of the advantages to the districts proposed to be included would be a saving of the extra charges in respect of both gas and water. The total quantity of gas manufactured in the year ending March 31 last, was 333,843,000 cubic feet. The capital expenditure on the works at the date named was £147,821; and the total amount of debt outstanding at that time was £241,201. The water undertaking was also in the hands of the Corporation. The original works for a supply from the Eden, acquired by the Corporation in 1866, became totally inadequate to properly supply the city and district, and they were abandoned in August, 1906, in favour of new works at Geltsdale—a gravitation supply—constructed under parliamentary powers in 1898 and 1906, and carried out under the supervision of Messrs. James Mansergh and Sons, of Westminster, at a total cost of £287,642. All the districts proposed to be included were in the statutory limits of the Corporation. They were at present being provided with mains and apparatus. The quantity of water supplied during the year to March 31 last, for domestic purposes alone was 437,013,000 gallons, equal to an average daily consumption of 21·38 gallons per head of the population for domestic purposes.

UNACCOUNTED-FOR GAS AT BURNLEY.

An Explanation by the Gas Engineer.

In accordance with instructions received from the Gas Committee, the Gas Engineer and Manager of the Burnley Corporation (Mr. John P. Leather) has presented a report on the increase in the unaccounted-for gas during the year ended the 31st of March last, compared with the preceding year. He says he has examined carefully the figures given in his annual report, and is unable to find any error therein, except that some of the gas given free for lighting public clocks was not included. The figures of gas sold include the gas registered as consumed at the Hospital and Nurses' Home; the quantity given free being deducted under the head "allowances" in the annual statement of accounts. This course, however, was not followed in the cases of some of the public clocks. The amount omitted in this way from the gas accounted for was 881,000 cubic feet in 1909-10, and 857,000 cubic feet in 1910-11. Mr. Leather explains that the amount of gas unaccounted for arises in two ways—from direct leakage from the holders, mains, and services, and by alteration in the volume of gas caused by variations in temperature and pressure. He says he took out the mean temperatures week by week during the last two years at the station meters, and the temperature during the corresponding week reported by the Medical Officer of Health for the earth at a depth of 4 feet, which might be taken as giving an approximation to that of the services entering the consumers' premises. Making the corrections in volume for the amount of gas manufactured each week, he found that, if the gas had been registered at the earth temperature, the volume in 1909-10 would have been 12,036,000 cubic feet, and in 1910-11 15,537,000 cubic feet, less than that reported—a difference of 3,500,000 cubic feet. In respect of pressure, the gas was supplied to the consumers in the latter year at about 6-10ths of an inch more than in the preceding year. This produced a compression of 1,040,000 cubic feet in the gas as supplied, which, he says, "represents better value obtained by the consumer in the quantity of gas paid for." The remainder of the increase in the unaccounted-for gas was probably due to actual leakage. During the year there were a number of cases of broken mains and drawn joints, due to movement of the ground in various places. Mr. Leather submitted a table showing the quantity of gas unaccounted for and the percentage on the make from 1905 to 1911 inclusive. The latter figures were: 5·09, 5·24, 5·18, 4·63, 4·76, 4·53, and 6·17. In the same period the mileage of mains rose from 146 to 170, and the number of services in use from 26,704 to 29,767. The unaccounted-for gas per mile of main in the year 1909-10 was 186,980 cubic feet, or 1073 cubic feet per service; while in the past financial year the figures were 274,370 and 1566 cubic feet respectively. In conclusion, he informs the Committee that a few years ago, Mr. D. Irving, of Bristol, made a return of unaccounted-for gas for the whole country over a period of eleven years; and the average he found was 7·02 per cent. on the make, 341,000 cubic feet per mile of main per annum, and 2632 cubic feet per service. Mr. Leather points out that even the exceptional figures for 1911 at Burnley compare favourably with this average.

After considering the report, the Gas Committee instructed Mr. Leather to arrange for the station meters at the works to be tested by the makers as soon as practicable, and to have a thorough examination made of the Stoneyholme gasholders and other plant through which it is possible for gas to escape.

THE ADVANTAGES OF CO-PARTNERSHIP.

Address by Mr. Henry Austin.

Before the members of the Warminster Literary and Debating Society last Friday, Mr. Henry Austin, formerly a Workman-Director of the South Metropolitan Gas Company, delivered an address on the value of co-partnership in industrial undertakings.

After giving his audience a few particulars of his early life, and attributing to co-partnership the fact that in his old age he was in a very comfortable position, Mr. Austin said he would make a proposition—it was not his own, but was the one adopted by Bishop Westcott in his address at the Co-operative Congress in 1901: "That all who combine in a business should be partners in it—partners in the contribution of capital, partners in profit and loss, partners in control and development, partners in responsibilities and honourable pride—a position which must tend to bring out unfailing support to vigorous labour, and untiring thought and glad devotion to social service; in other words, a man's full reward in elevation of character, apart from any financial advantage for a man's full work." He claimed that this had been the aim of the South Metropolitan Gas Company since the establishment of co-partnership in 1889. He himself had been elected five times as a Director, and had served in this capacity for eight years. One day in each week he sat at the Board, helping to organize a huge business, with a capital of eight millions sterling and with an immense turnover, and for the remaining five days he worked at his bench. He maintained that under co-partnership strikes were almost unknown, and that the shareholders did not attempt to impose upon the men. On the contrary, all forms of recreation were provided for the workers, and at the same time every encouragement was given to them to practice thrift. The interest on the men's savings had amounted to something like £33,000 in a little more than twenty years; and by means of the Building Society the men had acquired property to the value of £23,000. Every effort was made to guard against accident; an inquiry being held by the men themselves in each case immediately after the occurrence. In this way, the accidents had been reduced during the last few years from 8 to 4 per cent. of the number of men employed. The Directors did all in their power to increase the efficiency of the Ambulance Corps; and the first aid rendered had often been the means of saving life. Generous compensation was made in the case of disablement or death. One man had already received £800, and would continue to receive £1 a week as long as he lived; while the widow of another worker had received £500, and would be paid 10s.

per week for the remainder of her life. Mr. Austin said it was sometimes urged that co-partnership tended to make labour less mobile. He refuted this charge by stating that 150 workmen had sold out their stock at an average of £40 per man, and had emigrated to Canada. The workmen's holdings now amounted to £479,603; and the dividend on them had, during twenty-two years, reached £100,000.

Mr. Barnett, a works foreman in the South Metropolitan Gas Company, also spoke as to the smooth working of co-partnership. He said that after more than twenty years' experience he could honestly say he did not know of a single weak or bad point in the principle.

A discussion followed; and hearty votes of thanks were accorded to the speakers.

USE OF TAR FOR ROAD SURFACES.

In the House of Lords on Nov. 22, Lord Montagu of Beaulieu, in the course of some comments on the first report of the Road Board, congratulated the Board on the way in which the money at their disposal had been spent. He said they had resisted the temptation to indulge in ambitious schemes of road-making, and kept, in the main, to what he thought was the sound policy of providing better foundations for the superstructures which were to carry the heavier and more rapid traffic now upon the roads. What was wanted primarily was to have the roads dustless and mudless; and no one who had motored about England or Scotland this year could fail to have been struck with the greatly increased mileage of well-tarred roads. Viscount St. Aldwyn said he had no wish to criticize the Road Board, who appeared to have judged between the conflicting claims of different parts of the country with fairness and on proper lines. But he could not take the same view when it was a question of improving the surface of the roads by tarring or otherwise in order to keep down the dust nuisance, which was due solely to the motor traffic. There was no such nuisance before the invention of motors as there was now; and therefore he thought the entire cost of the improvement of the surface of the roads which was necessary to prevent the nuisance should be borne by the taxation which was derived from motors or petrol, instead of a burden being imposed on the ratepayers.

USE OF GAS FOR INDUSTRIAL PURPOSES.

At a recent meeting of the Special Purposes Section of the North of England Gas Managers' Association, Mr. J. H. SINGLETON, of Messrs. Fletcher, Russell, and Co., Limited, gave an address on "The Uses and Advantages of Gas for Industrial Purposes." It was illustrated by a number of lantern slides, and prints of various appliances had been brought for inspection.

In opening his address, Mr. Singleton remarked that probably few of his audience were aware of the very wide field open to the further use of gas for other than lighting and cooking purposes; but he hoped to show, before he had finished, that there was not one of those present who would not be able to find a new outlet or a new consumer who could make use of gas to advantage. In order to do this, it was necessary to be fully acquainted with some of the purposes to which gas was applied; and, in addition, to know the many advantages it claimed over other kinds of fuel. Having satisfied themselves on these two points, they were faced with the most difficult problem—viz., the cost of gas when used as a fuel. This was the item to which the practical commercial man gave most consideration.

Before proceeding to show upon the screen the different kinds of appliances to which he was about to direct the attention of his audience, Mr. Singleton mentioned that they were a very small selection of those made by the Company with which he was connected, and that they were the most up-to-date of their kind, and the result of many years' experience. The question of economy was a point to be well considered. He had often met manufacturers who would not entertain the idea of using gas; and he generally found their reluctance was based on past experience of employing some apparatus that was not adapted for the work, or was the production of some local genius who had a vague idea that he possessed the necessary qualifications for making a gas-furnace. This was the individual who did most harm in connection with furthering the use of gas in workshops. The appliances he was about to show were fitted with various kinds of burners, to suit the particular work for which the apparatus was designed. For example, where a temperature not higher than 1800° Fahr., or a bright red, was required, the ordinary low-pressure burner was used, and adjusted from 1 inch to 6 inches pressure. Then they had the high-pressure burner to work from 2 lbs. to 11 lbs. pressure, and also gas with air under pressure, for use where high temperatures were required, or for quick heating.

Mr. Singleton then proceeded to indicate the features of the appliances shown on the screen. He pointed out that low-temperature burners are used largely for melting metal which has a low melting point, unless the metal is to be melted on a large scale—as, for example, for heating the stereo metal-pots in printing establishments. These pots hold from two to five tons of metal, which must be of the same temperature all through. The metal is required spasmodically; and therefore a set of burners has been constructed to allow of some being turned out, and a sufficient number left alight to maintain the metal in a liquid state. Low-pressure burners are also applied to muffle furnaces used for assaying, enamelling, glass-firing, and many other purposes, when it is necessary to use a closed muffle, and a temperature not exceeding the melting-point of gold (approximately 2000° Fahr.) is required. Furnaces of this kind have been used for the firing of the coat-of-arms on 60 dozen of china at one charge, and doing two charges a day. No other fuel has an advantage over coal gas for this purpose, because the heat in a properly constructed furnace is so regular and so well under control. Low-pressure burners are applied to apparatus for carbonizing or case-hardening.

Gas-heated ovens of the ordinary type for japanning were shown. They are made either internally or externally heated; the former kind being used by the leading cycle manufacturers. An externally heated oven requires twice the quantity of gas needed for one heated internally. Pictures were shown of the most up-to-date furnaces employed for tempering, case-hardening &c.—appliances which are in use in the Mints at home and abroad. One 9 feet square and 18 inches high had a maximum consumption of gas, using air under pressure of 1 lb. to the square inch, of 1800 cubic feet per hour to attain a temperature of 1800° Fahr. But Mr. Singleton stated that 900 cubic feet of gas will raise an oven 3 ft. by 2 ft. by 1 ft. to a temperature of 2000° Fahr., and 400 cubic feet per hour will maintain it. A small furnace with a top chamber was shown, in which a temperature of 2800° Fahr. is obtainable in the bottom chamber; and a furnace 9 in. by 5 in. by 4 in., in which a temperature of 2000° Fahr. can be attained in 40 minutes with a consumption of 90 cubic feet of gas per hour, and kept at this degree with 40 cubic feet.

Mr. Singleton next showed a selection of appliances requiring high-pressure gas-burners; beginning with crucible furnaces, which will melt pure Mond nickel at a temperature of upwards of 3000° Fahr. He pointed out that a gas-heated furnace of this description has many advantages over furnaces heated by solid fuel, as they are more quickly heated up, more readily controlled, have a longer life than coke furnaces, occupy less space, and cause less waste. They are made to suit the air pressure from a fan or a pressure blower; the latter being recommended as the more economical in working. Various appliances for using gas for hardening steel tools, taps, dies, &c., were shown; also two methods of using gas for brazing articles ranging from delicate jewellery to the crank-shaft or propeller of a warship.

Examples of the use of open-flame furnaces were next exhibited. They are employed for forging up to 4-inch square bars for spade and pick making; also for forging files and chisels. Until quite recently, it was not possible to weld with coal gas; but this can now be done, at least on a small scale. A gas-heated veneering-plate, largely used in cabinet-works, was shown. Atmospheric burners are fixed under a cast-iron table top, and adjusted to keep the plate at the right temperature. In some cases the veneering is done by heating loose plates, which are placed on grid shelves, and heated in internally heated gas-ovens. The final picture was a combined brand and burner; the latter being of the high-pressure or blast type when used for continuous work. Many types of these appliances are in use.

At this point, Mr. Singleton said he thought his audience had seen a sufficient variety of appliances to convince them that gas heating for industrial purposes is a recognized industry. But if any further proof were wanted, he had prints of other articles which are made, and the use of which he would be willing to explain.

Coming to the subject of the cost of using coal gas as a fuel, Mr. Singleton said he did not wish to conceal the fact that it has many competitors other than solid fuel. For example, producer gas is a serious one, on account of its low cost. It does not, however, pay to instal plant for making producer gas specially for industrial purposes; and, moreover, it must be remembered that this gas has only about one-fifth the heating power of coal gas. Oil, too, is being largely used in some districts; but though it is a cheap and efficient fuel, it has its drawbacks, such as congealing in the supply-tank and carbonizing at the jet. Further, it is rather difficult to start, especially the crude oil. Then there is electricity; but Mr. Singleton said he thought his audience need not trouble themselves about this—at any rate, on a large scale. The cost of producing current was too high; and considering that the heat value is only five times that of coal gas, for commercial use it was not to be considered. A Board of Trade unit is equal to about 3434 B.Th.U., which is the average of 5 cubic feet of gas. If his audience compared the price of a unit of electricity with that of 5 cubic feet of coal gas, they would be able to form their own opinion. Finally there is petrol gas; but its heating value is not more than that of a poor producer gas.

In conclusion, Mr. Singleton said that, so far as he could see, therefore, the only competitive fuels which had to be considered seriously were the solid ones; and these had only their cost in their favour. He admitted that 1 lb. of coal has twenty times the number of heat units contained in a cubic foot of coal gas. But how many, he asked, could be utilized? Its great disadvantage was, he said, that the heat of coal could not be directed to the place where it was wanted; while that of coal gas could be, and, moreover, without the dirt, smoke, and trouble of continuous firing entailed by the use of coal.

Gas Fatality at Hull.—At the inquest on the body of a shoemaker, who was one of three men found unconscious from gas poisoning in a Hull lodging house, the Casualty House Surgeon at the Infirmary said he thought that in a small room it was quite possible for a person to be poisoned by coal gas in 25 minutes. The manager of the lodging house stated that when he looked into the room on the night of the occurrence the gas was burning low. He went again next morning, and noticed a smell of gas; the light being out. As the men were snoring, he fancied they were asleep; so he left, after turning off the gas. The tap on the gas-bracket had no stop; and no doubt it was dangerous. A new one had been put in since. The Jury found that death was the result of an accident, and recommended that greater attention should be paid to the gas in the rooms.

Power Gas Corporation, Limited.—It was mentioned in the "JOURNAL" last week that the Directors of this Corporation recommended the payment of a dividend of 4 per cent., less income-tax. In the report to be submitted to the shareholders at the eleventh ordinary general meeting on Thursday, they state that the results of the year's trading of Messrs. Ashmore, Benson, Pease, and Co., Limited, show a total profit of £14,257, to which has been added the balance brought forward, £2352, making together £16,609. Of this sum, £4000 has been transferred to the reserve, £9000 to the accounts of the Corporation for dividend, and the balance is carried forward. The results of the year's trading of the Corporation show a total profit of £13,907, to which has been added £2122 brought forward; making together £16,029. After placing £2780 to the reserve and paying the dividend recommended, there will be left a balance of £3264.

GAS ACCOUNTS.

A lecture was delivered last Wednesday, before the Incorporated Accountants' Students' Society of London, by Mr. A. C. GILLMAN, one of the students, on the subject of "Gas Accounts." There was a large attendance of members; and both the lecture and the subsequent discussion were followed with close attention.

The author commenced by describing shortly the differences existing between the various classes of gas undertakings—namely, statutory companies, municipally owned gas-works, and concerns not coming under either of these heads. The first and second were, he said, very different from the third class, owing to the parliamentary rights given them. The existence of the third class might be stated to depend practically from day to day on the goodwill of the local governing body of the district in which the mains were laid; and competition was also a possibility which could not altogether be ignored. There was, of course, a considerable difference in the manner of incorporation of parliamentary and ordinary joint-stock companies; and these he proceeded to point out. It was, speaking generally, necessary for statutory gas companies to read their Special Acts in conjunction with the Gas-Works Clauses Acts and other measures. Under the Gas-Works Clauses Act of 1871, their accounts must be in the form set out in Schedule B of the Act. Municipal bodies were not compelled to adopt this course; but the accounts had to cover the same period as the other accounts of the authority. The third class of gas undertakings was governed by several Acts; and the accounts might be issued in the form preferred by those concerned. Sinking funds had to be provided for out of revenue by statutory companies where works had been erected on leasehold land, and by municipal authorities for redemption of loans obtained as capital.

Mr. Gillman then went on to deal in the full detail suitable to his audience with the different books and forms of accounts to be kept by gas companies—beginning with the shareholders' or stockholders' register. Attention was drawn to clause 41, and following clauses, of the Companies Clauses Consolidation Act of 1845; and it was pointed out that the Special Acts of gas companies usually gave them power to raise money on mortgage to the extent of one-third of the capital raised. Continuing, he said it was most important in business undertakings that a proper record of cash receipts should be kept; and gas companies were no exception to the rule. Forms were distributed at the meeting showing the rulings for the collector's cash book, ordinary meters readings book, ordinary consumers' rolls, and fittings cost journal; and also a blank set of accounts drawn up on the basis of that set out in the schedule to the Gas-Works Clauses Act, 1871. The importance was emphasized of seeing that the wages paid by a gas company were properly allocated to the various operations in respect of which they might have been incurred; and in order to do this, the wages-book would be ruled with detailed analysis columns. Each man employed should be provided with a work-sheet, on which he must enter full particulars of the work he had done and the time he had been occupied upon it. In going through the revenue account, and explaining exactly what charges should come under each item, Mr. Gillman remarked that when a discount was allowed for prompt payment, he thought it should be charged under management on the other side of the account. Some attention was devoted to the statements of coals, gas made, sold, &c., and residual products; information being given as to how to ascertain the figures necessary for filling in the various particulars required. The working statements prepared, said the author, were generally three in number—based on the cost per ton of coal carbonized, cost per 1000 cubic feet made, and cost per 1000 cubic feet sold. A comparison of these three sets of figures would show at once the weak points of the working to anyone who understood what they revealed.

At the conclusion of his lecture, Mr. Gillman had a large number of questions put to him; and the replies to one or two of them may be noted. He said the stock of gas was not usually taken into account, because it was so small an item. In his statement of accounts, he had shown the collectors' wages under management. Sometimes, they were put under distribution, and in other cases under management; while some people allocated the amount under the two headings. One speaker said he had never seen statistics based on the make, and that "Field's Analysis" only worked the figures out on the two bases of cost per 1000 cubic feet of gas sold and per ton of coal carbonized. Well, his idea in saying that costs were sometimes shown on the bases of gas made and gas sold was to show the proportion due to gas unaccounted for. This was very useful at times. He did not know of a statutory form of account for gas and electricity companies combined. Unaccounted-for gas was, as a rule, he thought, mentioned in the directors' report rather than in the accounts; but, of course, the figure could be shown in the accounts. As to parliamentary costs, he believed there was generally a clause in Private Acts which gave specific power to capitalize the cost of obtaining the Act; and therefore this was done. Unsuccessful opposition to Parliamentary Bills must, however, be written off revenue; and the same remark would hold good when a company applied for an Act and failed to get it. Another speaker said that for small undertakings he did not recommend a consumers' roll, but an ordinary ledger account for each customer. He (Mr. Gillman) did not agree with this, and thought that what was good for a large company was good also for a small one.

York Gas Bill.—Referring at a meeting of the City Council to the York Gas Company's Bill, Alderman Meyer pointed out that if allowed to go through in its present form it might prevent the Council ever being able to purchase the undertaking. He said he hoped that they would insist on the Bill separating the city undertaking from the outside undertaking, so as not to prevent its purchase at a future date. A Special Sub-Committee was appointed to deal with the matter.

Electric Competition Met.

RICHMOND'S Auto Gas Flasher will help you increase your Gas Output by adding permanently to your lists the best tradespeople in your district.

It will compete successfully with Electric Signs, because it is cheaper to instal, simple to use and maintain. Made in two sizes, Flasher only, from **35/9** list.

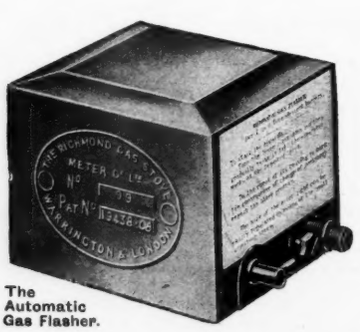
Use one complete with "A. B. C." Gasfire Sign in your Showroom.

PAMPHLETS FREE
ON APPLICATION.

THE **RICHMOND** GAS STOVE & METER CO., LD.

Gas Apparatus Specialists,

Offices & Showrooms: 132, Queen Victoria St., London, E.C.
General Offices & Works: Academy Street, Warrington.



The Automatic Gas Flasher.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Aberdeen Town Council on Monday, the Gas Committee recommended that the maximum wage to able-bodied labourers and efficient carters be increased by 1s. per week, that the maximum rate of wages to gas-fitters be increased to 6¾d. per hour, that overtime be paid for at time-and-a-quarter, that holidays consist of the five statutory holidays as at present, and that temporary hands receive holidays as they occur, provided they have been at least two months in the service of the department. The increase proposed by the Committee, it was stated, would amount to an annual charge of £348. The recommendations were adopted by 26 votes to 7.

Mr. J. Gordon gave notice, in the Peterhead Town Council this week, that at the January meeting he would move that Mr. R. Cockburn Millar, C.A., of Edinburgh, or Mr. Courtenay J. Shiells, C.A., of Edinburgh, be employed to examine the books, vouchers, &c., and investigate into the whole management of the Gas Department, with power to employ such expert and practical assistance as might be found expedient, and report. At the same meeting, Bailie Bernie, the Convener of the Gas Committee, said they had been passing through a trying and regrettable experience, which unfortunately was not yet finished. The Gas Committee had done what they could to sift the matter to the bottom; and the report they procured had been adopted by the Town Council, subject to its acceptance by the Under-Secretary for Scotland. The report had been before the Secretary for Scotland for the past five months; and whatever the Under-Secretary recommended he was sure the Gas Committee would be prepared to do.

At Portsoy, where the gas supply is acetylene gas, Bailie M'Donald, the Convener of the Gas Committee, informed the electors a few evenings ago that they had been able to reduce the price of gas, as from Oct. 15, from 5s. to 4s. 9d. per 100 cubic feet, and that they expected to be able to reduce it still further next year.

A statement made by Provost Ross, of Buckhaven, to the effect that electricity at 5d. per unit was equal in cost to gas at 2s. 3d. per 1000 cubic feet, led Mr. J. J. Scott, the Manager of the Kennoway Gas Company, to controvert it. He has sent in a statement to the Town Council, showing how, light for light, gas does not cost half what electricity does at 5d. per unit. One result of the letter is that the Town Council have resolved to reconsider the lighting of Cameron Hospital, and probably to take the lighting into their own hands—dealing with neither the electricity nor the gas undertaking.

Sheriff-Substitute Smith Clark has given his decision in a small debt action in Glasgow, in which John Harvie sued the Corporation of Glasgow for £20 as damages for injuries sustained by him on Sept. 11 last, at the junction of Govan Street and South York Street. As he was passing there, an explosion occurred in an underground culvert, by which the cover of a manhole was blown into the air, and he was thrown down and injured. Pursuer maintained that the manhole had not been sufficiently inspected. The Corporation, on the other hand, contended that they were in no way responsible, there having been no negligence on their part. The Sheriff gave the defenders absolvitor, with £1 of expenses.

In Dunfermline, the Corporation have granted an increase of wages to the extent of 4d. per shift, making the shift wage 4s. 8d., to the third and fourth grade stokers in the gas-works.

In connection with the proposal to instal vertical retorts in the burgh gas-works at Wishaw, by which a considerable saving in the cost of working is anticipated, a deputation from the Wishaw Town Council recently visited the Helensburgh Gas-Works, and inspected the vertical retorts in operation there.

On the evening of Thursday of this week, Mr. Peter Fyfe, the Chief Sanitary Inspector in Glasgow, delivered a lecture in the Kent Hall, St. Andrews's Halls, under the auspices of the Glasgow and West of Scotland Branch of the Smoke Abatement League. Sir John Ure Primrose, Bart., presided. Mr. Fyfe's subject was "Air Pollution in Glasgow and other Towns in Scotland." He gave the results of observations taken in different towns during December and January a year ago; and the variation shown was very great. In Bo'ness, with about 10,000 inhabitants, the rate per annum upon each acre of surface amounted to 2·27 cwt., of which 0·83 cwt. was soot. In Falkirk, with 34,000 population and great iron-works on its northern boundary, air pollution amounted to 19 62 cwt. per acre per annum; and the proportion of soot or carbonaceous matter was 5·77 cwt. In Glasgow, there was an invisible fall of solid matter from the air during December and January of almost 7 cwt., and in Coatbridge of 10 cwt., on each acre. He had been assured by the Manager of a Coatbridge steel and iron works that not only was it practicable and economical to do the work perfectly by gas, but that it was done every day in two iron and steel works in Coatbridge It was estimated that there was a discharge into the atmosphere of Glasgow from domestic chimneys of soot and tarry substances of fully 120 tons. He appealed to the women of Glasgow on the question of the actual costs as between a coal-fire and a gas-fire. For 6d. they could burn a gas-fire for twelve hours. For cooking, it had to his mind been conclusively proved that gas at Glasgow prices easily beat coal at 10d. or 10½d. per bag. He would like such an amendment of the law as would compel landlords to instal in their properties gas-piping of such dimensions as would be suitable for all heating and cooking purposes.

The lecture on "Water-Heating Apparatus" by Mr. James W. Wilson, of Leeds, which was mentioned in the last number of the "JOURNAL" as having been given in the North of England and in Edinburgh, was delivered in the Technical College, Glasgow, on the evening of Wednesday last. Bailie Paxton, the Convener of the Gas Committee, who presided, said this was the first of a series of lectures arranged by the Gas Committee, to be given during the winter, on the great scheme of air purification. There was a large attendance, including

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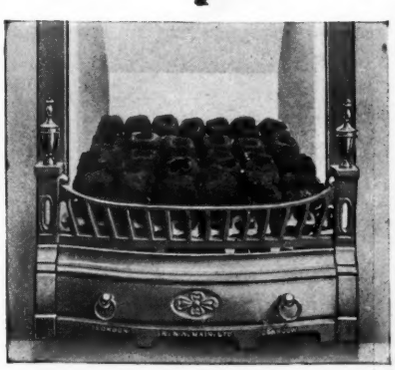

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officials and employees of the Gas Department and members of the Plumbers' Association.

On the afternoon of Saturday, the 2nd inst., the Aberdeen Association of Civil Engineers, of which Mr. S. Milne, the Gas Engineer, was recently appointed President, and read a paper to the Association on carburetted water gas, paid a visit to the Corporation gas-works for the purpose of seeing the water-gas plant. Mr. Milne described the whole of the plant and its working to the visitors. The coal-gas plant and its working were also shown and explained to them. A cordial vote of thanks was accorded to Mr. Milne and to Mr. J. A. Sangster, the Convener of the Gas Committee, for their kindness in allowing so interesting a visit.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 786.]

LIVERPOOL, *Dec.* 9.

Sulphate of Ammonia.

There has been a fair demand for early delivery all through the week, but the present output has proved sufficient to meet all requirements, and prices have not undergone any quotable change. The purchasing has largely been on account of dealers with former contracts still to cover, but there have also been some new export orders in the market. At the close, the tone is quietly steady at £14 2s. 6d. per ton f.o.b. Hull, £14 3s. 9d. per ton f.o b. Liverpool, and £14 6s. 3d. per ton f.o.b. Leith. In the forward position, makers continue to ask £14 7s. 6d. to £14 10s. per ton f.o.b. at the principal ports for spring shipment, but no fresh contracts have been reported at these figures. It has transpired, however, that middlemen have been selling abroad at about 2s. 6d. per ton less.

Nitrate of Soda.

The position of this article remains without alteration in either tone or value, and the quotations are repeated at 10s. 1½d. per cwt. for ordinary and 10s. 4½d. for refined quality, on spot.

LONDON, *Dec.* 11.

Tar Products.

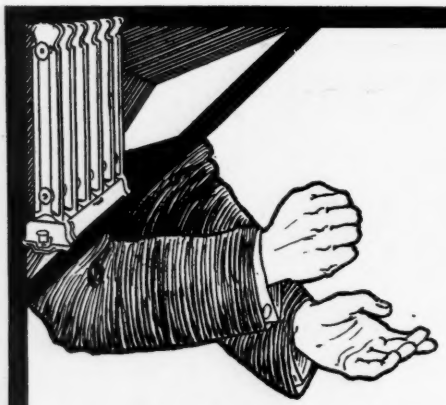
The market for pitch has been very firm indeed throughout the past week, and makers report that they have refused very good prices. Creosote is very firm; but there does not appear to be much business doing just now. Benzols are still strong, especially for this year's delivery. Naphthas are in fair demand, and prices show a tendency to improve. Carbolic is very firm, especially for prompt delivery; while good prices are being offered for delivery all over next year. Creosote salts are in good demand, as is customary at this time of the year. The few contracts which are being offered are now fetching very high prices.

The average values during the week were: Tar, 22s. 6d. to 26s. 6d; *ex* works. Pitch, London, 41s. 6d. to 42s. 6d.; east coast, 41s. to 41s. 6d.; west coast, Clyde 40s. 6d. to 41s. 6d., Manchester 40s. 6d. to 41s., Liverpool 41s. to 41s. 6d. Benzol, 90 per cent., naked, London and East, 10¼d. to 10½d.; 50-90 per cent., naked, London and North, 9¾d. to 10¼d. Toluol, naked, London, 9d. to 9½d.; North, 8½d. to 9d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3⅞d. to 4¼d. Solvent naphtha, naked, London, 10¼d. to 10½d. f.o.b.; North, 9½d. to 9¾d. f.o.b. Heavy naphtha, naked, London, 11⅛d. to 1s. f.o.b.; North, 10d. to 10¼d. f.o.b. Creosote, in bulk, London, 2⅞d. to 3d.; North, 2⅝d. to 2¾d., liquid. Heavy oils, in bulk, 3d. to 3¼d. Carbolic acid, casks included, 60 per cent., east coast, 2s. 5d. to 2s. 6d.; west coast, 2s. 4½d. to 2s. 5½d. Naphthalene, £4 10s. to £9; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1⅛d. to 1⅜d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been quiet during the past week, and prices show a distinctly easier tendency. The principal Gas Companies are still quoting £13 17s. 6d. Ordinary London makers are asking £13 7s. 6d., Hull £14 2s. 6d., Liverpool £14 3s. 9d. to £14 5s., Leith £14 7s. 6d., but it is doubtful whether business could be done at these figures.

Salcombe District Council and the Gas-Works.—It has been decided by the Salcombe Urban District Council to postpone for the present consideration of the question of purchasing the gas-works, to which reference was made last week. The Chairman (Mr. J. Fairweather), reporting on the negotiations which had taken place between a Committee of the Council and the Directors of the Gas Company, said they were continually hearing complaints with reference to the gas; and if the works were under the control of the Council, they would be able to improve matters. Difficulties now arose as to the breaking up of the roads for laying mains, and also with regard to the public lighting; and these would be avoided if the works were under their own control. The Council would be able to put more capital into the undertaking for the purpose of improving the plant, and also for the extension of the mains; and they could provide prepayment meters, by means of which the consumption of gas by the working classes would be increased. It was proposed to appoint a valuer to represent the Council, and another to represent the Gas Company. If they could not agree upon a sum to represent the value of the works, there would have to be an umpire to decide upon the price which the Council should pay. The Clerk (Mr. C. E. Turner) pointed out that the Council would have to obtain a Provisional Order before they could undertake to supply gas. After discussion, it was decided to postpone consideration of the subject until the Council's liability in connection with a scheme of sewage disposal had been ascertained.



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Maintenance

COAL TRADE REPORTS.

Northern Coal Trade.

There has been a strong demand for coal, to stock for the larger needs of the next week or two; and the deliveries have been heavy. In the steam coal trade, the price of best Northumbrians has risen to near 12s. 6d. per ton f.o.b. Second-class steams are from 11s. to 11s. 6d. per ton; and steam smalls from 5s. 6d. to 6s. 6d. The collieries are working well, and the exports are full. In the gas coal trade, the demand is now at its fullest, both for stocking and to meet the present heavy consumption. Best Durham gas coals have been sold in small lots as high as 13s. per ton f.o.b.; and from this figure down to 12s. 6d. are the current quotations. Second-class gas coals are from 11s. 6d. to 12s. per ton; while for "Wear specials," up to 13s. 6d. per ton f.o.b. is named. A very large proportion of the production of gas coals is taken up by the long contracts; so that only small lots can be taken at the above current quotations. The high rates of freight to the Mediterranean ports are impeding the shipment of gas coals at present, though the general exports are up to the average. The all-round high prices of Durham coals have also some effect on the gas coal values. Coke is firm. Good gas coke is from 14s. 6d. to 15s. 3d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade continues to be exceedingly brisk; all classes being in strong demand. Foreign buyers are commencing to fix up their contracts for next year's delivery. The prices now quoted are: Ell, 11s to 12s. per ton f.o.b. Glasgow; splint, 11s. 9d. to 12s.; steam, 10s. 6d. to 10s. 9d. The shipments for the week amounted 339,909 tons—a decrease upon the preceding week of 5716 tons, but an increase upon the corresponding week of 15,267 tons. For the year to date, the total shipments have been 15,333,994 tons—an increase upon the corresponding period of 342,801 tons.

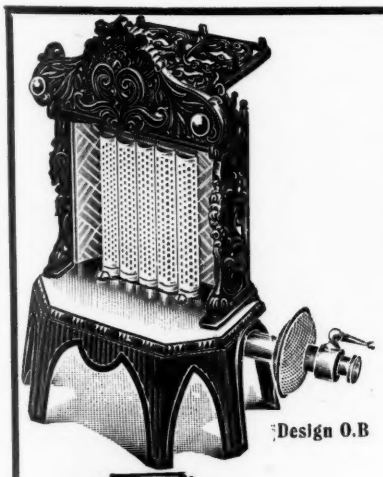
Public Discussion of Officials' Salaries.—At the meeting of the Birmingham City Council, during a discussion on a general instruction to Committees, an amendment was moved to the portion which states that there is to be reported to the Council "any proposal for the increase of the salaries of any officers when such proposed increase shall amount to £50 and upwards." The amendment was to the effect that £25 should be substituted for £50. Alderman Sir Hallewell Rogers said he hoped the amendment would not be carried. It was difficult enough now in some departments to give necessary increases to certain officials without their names coming before the Council. The Gas Committee had lost several valuable officials because they did not care to have their names discussed in the city when they were duly entitled to increases. If they were to have a limit, he would rather it were £100 than £50; but if they were to go down to £25, the Council would be taking away from the Committees the confidence they were supposed to have in them. The amendment was lost.

Manchester and a Municipal Coal Supply Scheme.

The question of establishing a municipal coal supply was discussed at last Wednesday's meeting of the Manchester City Council. The subject was raised by Mr. Phillips, who moved the appointment of a Committee. In the course of his remarks, he said that as the Corporation were now purchasing 500,000 tons of coal annually for the gas-works, it would only be going a step farther to buy a similar quantity for the purpose of selling it to the public. He argued that if the Corporation had the coal supply in their hands they would be in a much better position for dealing with the smoke nuisance, besides making a profit from such a department to go in relief of the rates. The opinions of those opposed to the scheme were voiced by Mr. Holden, who pointed out that at least 80 per cent. of the coal consumed by the people was delivered in small quantities; and he added that there was no possibility of a corporation being able to sell coal cheaper than private traders. Mr. Hargreaves had a tilt at the Socialist and Labour members. He said that if these gentlemen wanted to go into the coal trade he would sell them a pit. If they gave him 6d. a ton royalty, they could try their hands at it. On a show of hands, the proposition was defeated by a large majority.

Worthing Gas Company and Mr. Schweder's Tunnel.

The East Preston Rural District Council had under consideration last Tuesday a letter from the Worthing Gas Company, giving notice of their intention to open the road over Mr. Schweder's tunnel in Goring Lane, for the purpose of complying with the order recently made upon them by Mr. Justice Eve [see *ante*, pp. 327, 399], and also for laying a broader and more shallow kind of pipe. Mr. Langmead moved that, on the Company giving an undertaking to reinstate the road to the satisfaction of the Council and their Surveyor, permission should be given to them to open the road in accordance with the plan submitted. He appealed to his colleagues to sink their private feelings in this matter, and treat the Company's application in the same way as they had treated other applications to open the highway in the past. Mr. Pring, who seconded the motion, also appealed to the members to take a broad view of the matter; remarking that he could not see any legitimate reason for refusing to allow the Company to do what they wanted. The motion was, however, strongly opposed by Mr. Turner, who warned the Council against being drawn into possible litigation, of which they had already had a hint from Mr. Schweder's Solicitors. Mr. Schweder said that if it was proposed merely to give the Company permission to open the road and reinstate it, he should not oppose it; but if they went further and sanctioned any plan for laying a new main, he should at once join the Council as defendants in any proceedings he was taking. If the Council refused their consent, the Company could go to the Justices; and he advised his colleagues to let them take this course, and have nothing to do with the matter as a Council. In the result, the motion was adopted, with the concluding words, "in accordance with the plan submitted," struck out.



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Birmingham Ironmongers and the Gas Committee.

According to a leading article in the "Ironmongers' Weekly" for the 2nd inst., the gas-fitters, ironmongers, and other tradesmen of Birmingham are up in arms against the proposal of the Gas Committee to supply consumers in certain thoroughfares with gas direct from the main at a fixed charge per annum—lamps, mantles, and attendance included. The opponents of this method contend that it is unfair to tradesmen who, with the idea of being fair to their assistants, close at a reasonably early hour. They say that if a tradesman is charged so much per light, or at any rate a certain fixed charge is made for gas, no matter how much he may consume, then the shopkeeper who tries to be conscientious and fair to those in his employ is prejudiced, because the trader who works excessive hours is not punished in any way by reason of the certainty of augmented gas bills. The proposal is characterized as bad; and by bringing it forward, the Committee are charged with "wilfully placing a premium upon carelessness and waste." Another matter of which complaint is made is the supply by the Committee of only certain types of mantles, so that the public have no choice.

Winding-Up of the Gas Economizing and Improved Light Syndicate, Limited.

Last Tuesday, a petition, presented by the Plaissetty Manufacturing Company, for the compulsory winding-up of the Gas Economizing and Improved Light Syndicate, Limited, came before Mr. Justice Swinfen Eady, in the Chancery Division of the High Court of Justice. Petitioners, who are creditors on a dishonoured bill, were represented by Mr. Hewitt, who said the petition was supported by creditors to the amount of £1291. Mr. Hodge, for the Company and 22 creditors for £425, who opposed the petition, suggested that there should be an adjournment, as no good could possibly come from a winding-up order. The creditors would do much better by leaving things in the hands of the Receiver, who had been appointed at the instance of debenture-holders. The Company were not insolvent, but only in temporary difficulty; and the Receiver hoped all creditors would be paid in full. The debts amounted to £2900; and it was believed that, if the petition stood over, the majority of the creditors would oppose the winding-up. The Company were prepared to submit to the appointment of a Committee of Investigation; but they deprecated the expense of a compulsory order, which would not operate at all for the benefit of the unsecured creditors. The concern was a perfectly honest one, and the year before last there was a profit. Last year, however, there was a trading loss of £600 odd, due to a large consignment of mantles to Egypt having been returned. His Lordship declined to grant an adjournment, as he thought there had been ample time since the presentation of the petition to ascertain the views of the creditors. He made the usual order for compulsory winding-up.

West Greenwich Gas-Works Institute.

Last Saturday evening, the annual dinner in connection with the West Greenwich Gas-Works Institute was held under very successful conditions. About 130 members and friends were present. Mr. J. F. Braidwood (the President) was in the chair; and he was supported by Mr. W. Doig Gibb (the Chief Engineer of the South Metropolitan Gas Company), Mr. F. M'Leod (the Secretary), Mr. J. D. C. Hunter and Mr. J. Newbold (Employee-Directors), Mr. P. Richbell (Chief Cashier), Mr. C. T. Drumgold (Chief Storekeeper), Mr. J. White and Mr. W. S. Borthwick (East Greenwich Station), Mr. H. W. James (Ordnance Wharf), Mr. W. A. Barnett (Rotherhithe), and Mr. H. Austin (late Employee-Director). In proposing the prosperity and welfare of the South Metropolitan Gas Company, the President said that they had one of the best Chairmen and Boards of Directors possible. They had also the satisfactory scheme of co-partnership, by which they had £40,000 divided among them this year. This was no small thing; and there were also various kindnesses and privileges accorded to them. Without all this, many of them would not have had anything beyond their weekly wages. Mr. M'Leod, in responding, said he had a very comprehensive reply to make, as it was difficult to come to a gathering such as this, and think of the Company's prosperity, without realizing that all present were bound up in it. However, to retain this prosperity, the combined efforts of all co-partners were required, from the men in the humblest position to the highest. No doubt, the labour unrest in the country during the last few months was due, to a large extent, to the fact that employers did not take the same interest in their men as in the case of the South Metropolitan Gas Company. He also pointed out, especially to the younger employees, that many of the elder ones wished that the co-partnership scheme had been started some twenty years earlier—this fact plainly showing that juniors should make the most of their opportunities to provide for an easy time in their old age. Mr. Hunter proposed "The Chairman," which toast, after being enthusiastically honoured, was duly acknowledged by Mr. Braidwood. During the evening, the prizes won at the flower show held in August last, and also for the various sporting events, were distributed by the President and Mr. Doig Gibb.

Birkenhead Gas-Works Extensions.—The Birkenhead Town Council have decided to proceed with the first instalment of the gas-works extension scheme approved on Oct. 28, 1908, involving an outlay of £114,000. It is proposed to enlarge both the manufacturing and storage plant upon the present site in the centre of the town, acquire land in the immediate neighbourhood and also at a distance, and erect subsidiary works. The work to be first undertaken will be the construction of a four-lift gasholder and tank for the new Laird Street site. The plans include the laying of a high-pressure main from the present works to the new North End station, and the provision of boosting plant. This portion of the scheme will cost £32,253; and application is to be made to the Local Government Board for sanction to a loan to carry it out.

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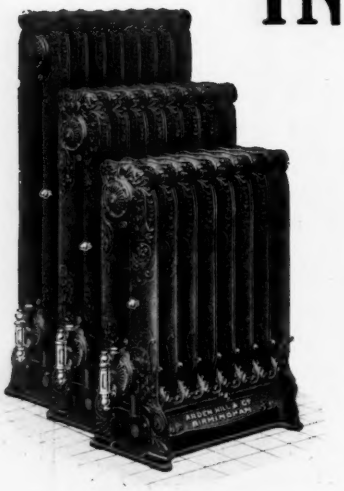

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Price of Gas at Birkenhead.—The members of the Birkenhead Town Council have been informed that the Gas Committee have had under consideration for some time the question of reducing the price of gas; and, as the result, they had determined to lower the charge after March 31 next. The quantity of gas supplied for a penny to the users of prepayment meters will also be increased.

Municipal Coal Supply Question.—At the meeting of the Bradford City Council to-day, Mr. Cowling will move a resolution in favour of instructing the Finance and General Purposes Committee to appoint a Special Sub-Committee, consisting of the Lord Mayor and nine members (three representatives of each party), to consider and report during the next six months as to the desirability or otherwise of establishing a municipal coal supply—the Sub-Committee to be empowered to obtain expert advice if they deem it expedient.

The Question of the Free Hire of Gas-Stoves at Rochdale.—At a meeting of the Rochdale Town Council last Thursday, Mr. Shawcross inquired, when the minutes of the Gas and Electricity Committee were brought forward for confirmation, whether the Committee had considered the question of lending gas-stoves free of charge; the gas to be supplied through the ordinary meter at the usual rates. Mr. Walker, the Chairman of the Committee, in the course of his reply, said they had not yet decided "to work the miracle" of the free supply of stoves.

Quality of the Ferndale Gas Supply.—At a public meeting which was held to consider the question of the alleged defective gas supply, representatives of the Ferndale Gas Company who were present pointed out that intimation had been made some time ago that they were about to carry out changes at the works which would necessarily cause some slight inconvenience. They, however, never anticipated such a prolongation of the trouble. The fault did not rest with the Company, as the Contractor had been unable, owing to a strike, to complete his work in the stipulated time.

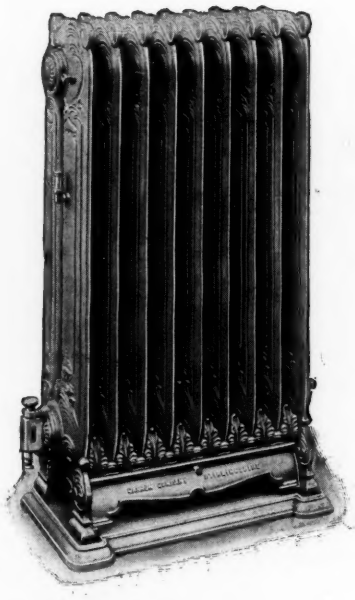
Coal and Tar Prices at Leeds.—On the minutes of the Gas Committee coming before the Leeds City Council, Alderman Badlay objected to the purchase of coal and the disposal of tar being left in the hands of a Special Sub-Committee, and moved an amendment to refer the matter back. Mr. Ratcliffe, the Chairman of the Committee, explained that this system came into force four or five years ago, and had been of great service in breaking down a ring of coalowners, and enabling the Corporation to obtain coal below the price fixed by the Coalowners' Association. Before this, the facts having been laid before the Council, everyone had been able to find out what was paid to any particular individual. Members of the Council could still get information; but if they wanted 300,000 tons of coal bought in the best market, they would do well to leave it to the Sub-Committee. In regard to the tar, this also was best left to the Sub-Committee. For several years now the department had managed to get what was known as the highest market value. In this respect Leeds had done infinitely better during the last twelve months than any other town he knew. The amendment was defeated.

Public Lighting of Carnarvon.—At last the Carnarvon Town Council have decided to rescind a resolution passed last September in favour of adopting some scheme (the details of which remained to be settled) for lighting the main streets by electricity. Mr. Hughes, in moving that the resolution be rescinded, contended that the Council were not entitled to burden the rates unnecessarily to benefit the electricity system at the expense of the gas-works, which were the property of the town—especially as the weight of public opinion was decidedly against the scheme. Alderman Thomas, who seconded, claimed that Carnarvon was already as well lighted as most towns of its size; and the Council were therefore not justified in adding to the rates. A representative of the Electricity Company pointed out that the proposal was to double the present candle power in particular streets for £100 a year; and as the Gas Committee were prepared to allow a reduction of £84 on their bill, the increased cost to the ratepayers would not be more than £16 a year,

Bristol Workhouse Water Supply Case.—At a recent meeting of the Bristol Board of Guardians, the Finance and General Purposes Committee reported that, under the authority previously given, action was taken against the Bristol Water-Works Company to enforce the claim of the Guardians to a supply of water for domestic purposes on the basis of the annual value of premises; and it duly came on for hearing in the High Court of Justice, before Mr. Justice Eve. [See *ante*, p. 399.] The decision was against the Guardians. The Committee were advised that there was a reasonable prospect of reversing this by carrying the case to the Court of Appeal; and as in their view the matter was of great importance, and the present charges of the Water Company were excessive, they recommended the Guardians to authorize notice of appeal to be given. In answer to a question, the Clerk said the water supply for the Workhouse and the Children's Homes cost about £1350 a year; and if the Guardians succeeded in the appeal, it would not cost them more than £750. The resolution was adopted with a few dissentients.

Quality of the Gas Supply at Lisburn.—Some letters complaining about the gas supply having been received by the Lisburn Urban District Council, the Gas Manager (Mr. J. Brodie) was called upon to give an explanation. He said the very poor and defective light experienced for some days was due to an accident which occurred at the gas-works, and which was not reported to him until the following morning. The supply, as a consequence, ran very low; and it took almost a week to recover the stock. He trusted there would be no further trouble, though the demand was in excess of the output with the present plant. Mr. Wilkins, the Chairman of the Gas Committee, contended that the gas had been bad for some time, and that the accident had nothing to do with the defect. Both quantity and quality were lacking; and something would have to be done, as the people were compelled to use candles and oil-lamps in their shops and homes. The matter was allowed to drop; it being arranged that the Gas Committee should meet, if necessary, with Council powers, if an improvement of the supply was not effected.

CARRON



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THE experience of over 150 years stands behind all "Carron" manufactures. Their unrivalled resources enable Carron Company to produce Radiators that are unsurpassed for style, finish, and efficiency. Carron Company hold large stocks of finished Radiators and Castings, and can execute orders for any size of Radiator on receipt.

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LONDON—(City) 15, Upper Thames St., E.C.; (West End) 23, Princes St., Cavendish Sq., W., and 3, Berners St., W.; LIVERPOOL—22-30, Redcross St.; MANCHESTER—21, Brazennose St.; BRISTOL—6, Victoria St.; BIRMINGHAM—218, 220, 222, Corporation St.; NEWCASTLE-ON-TYNE—13, Prudhoe St.; EDINBURGH—114, George St.; GLASGOW—125, Buchanan St.; DUBLIN—44, Grafton St.

Theft of Water for Laundry Purposes.—At the Portsmouth Police Court on Friday week, Edward Frank Martin, a laundry proprietor, was charged with stealing water the property of the Portsmouth Water Company. The water was supplied to premises of which the accused was the occupier, and conveyed by him across a courtyard to other premises in which he had a laundry. On the discovery being made by the Company's Engineer (Mr. H. Ashley), their Chief Inspector (Mr. Willcox), and two detectives, Martin admitted that he had taken the water on several days a week for a period extending over eight or nine months. He pleaded guilty, and said he was anxious to pay for the water he had used and the expense to which the Company had been put. The Bench imposed a fine of £3, and expressed the hope that the case would act as a deterrent to others who might be committing a similar offence.

Loughborough Corporation Gas Undertaking.—At the meeting of the Loughborough Town Council on Monday last week, the accounts of the gas undertaking for the six months ended Sept. 30 were submitted. The total expenditure was £6311, and the total revenue £8941; showing a profit of £2630. The sale of gas produced £6277; and residuals yielded a return of £1633. Alderman Bumpus said he thought the result was satisfactory; the increased profit for the half year being £436. This was the more gratifying in view of the competition of electricity. The ordinary consumers, apart from the slot installations, had decreased by about 70; but the slot consumers had come to the rescue, for there were 325 more than in the corresponding half year, and showed a very great improvement in the condition of things in the town. This was evidenced not only by the increase in the slot consumers, but also by the extra quantity of gas used. The increase was 7¾ per cent. in the total quantity of gas sold during the year; so that, in the face of all difficulties, the gas undertaking made a very brave fight.

Gas-Stoves in Increased Demand.—The following appeared under the "London Correspondence" in the "Ironmongers' Weekly" for the 2nd inst.: "The increase in the price of coal in the London area has not been without a marked effect upon the suburban trade; for the public have shown a strong disposition to take up gas-stoves. Incidentally, it may be said that gas has become much more popular of late; and the prospect of dear coal during the coming winter has induced a large number of people to instal gas-fires. Doctors appear to be agreed that there is nothing of an unhealthy nature arising from this system of heating; and accordingly the public have been widely educated on the subject of gas-fires by the circulation of a quantity of literature on the subject. The output during the past month in the matter of stoves in the London district has been exceedingly large. This has been assisted by a reduction in some districts of the price of gas; and a further reduction is announced for the immediate future. As a consequence, stoves of all kinds have been in good demand; and ironmongers who have encouraged this business have done very well out of it."

Scarcity of Water at Johannesburg.—A critical situation has arisen at Johannesburg owing to the scarcity of water. The main reservoir, from which the supply for the town is drawn, was practically exhausted last Tuesday evening; only 50,000 gallons being available for use. At two o'clock on Wednesday afternoon the Water Board supply had fallen to rather more than 6½ million gallons, of which 3 millions were allotted to the mines, a like quantity to the Municipalities, and the rest to the railways and various industrial concerns. On Thursday the Board reduced the supply to the mines by 7½ per cent. daily; and the water thus saved is being given to the Municipality. On Friday, however, the town was visited by the heaviest hailstorm which had occurred for twenty years—according to telegrams received by our daily contemporaries. This replenished the reservoir to a considerable extent; but the restrictions on the supply were not relaxed in the slightest degree.

Gas v. Electric Light for Schools.—At the meeting of the Tottenham Education Committee last week, there was a discussion as to the comparative suitability of gas and electric light in schools. A Committee brought up a recommendation that the Architect should arrange for the wiring of a new school for the purposes of electric lighting. The Medical Officer of Health, writing to the Committee on the subject, said that while, from a general health point of view, electric light was better than gas, the light possessed no special advantage over incandescent gas as regarded eyesight. The Architect said he did not know how the London County Council schools were lighted, but he believed in the majority of cases it was by gas. Mr. Clegg, a schoolmaster, said he had experience of electric light in a London County Council school some years ago, and was delighted to get to one where it was not in use, as it affected the eyes. The recommendation was adopted.

Tar-Sprayed Roads in Lancashire.—One of the subjects discussed at the last meeting of the Lancashire Farmers' Association, held in Preston, had reference to the alleged dangerous state of the roads. Mr. T. H. Holborn, the Secretary, said he wrote to the Surveyor to the Lancashire County Council on the matter, and had received a reply to the effect that the county authority found itself in a difficult position in regard to this question. On the one hand, there were complaints from farmers as to the dust nuisance if tar-spraying had not been done; and, on the other, they received complaints as to the slippery nature of the roads if they had been so treated. The Surveyor added that he had given instructions that all gradients should be sanded, so as to minimize the danger. Mr. R. Harrison, of Hoole, stated that in his district the tar-spraying of the roads had been very beneficial; and Mr. Pye, of Goosnargh, argued that roads so dealt with were much appreciated by farmers generally. On the other hand, Mr. Whittaker declared that the roads round about Wigan were like glass as a result of the tar-spraying. It was eventually decided that the Secretary should write to all local authorities with a view to having the roads made less dangerous.

BRADDOCK'S PATENT "SLOT" METERS

No. 261. Dry "Slot" Meter.

THE BEST SLOTS MADE.

No. 265. Wet "Slot" Meter.

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Sale of Gas Shares at Windsor.—At a sale by Mr. H. J. Hetherington at Windsor last Wednesday, the following prices were obtained for shares of the Windsor Gas Company: "O" shares of £20, £44 to £44 2s. 6d.; "N" shares of like nominal value, £32; "P" shares of £8, £10 10s. to £10 15s.; and "N" shares of similar value, £12 5s. On the same occasion, "A" shares of £20 each in the Eton Gas Company realized £31 15s. apiece; and some "B" shares of £15 fetched £21 5s. each.

Theft of Gas at Portsmouth.—At the Portsmouth Police Court last Wednesday, Mr. William Burrows pleaded guilty to the charge of stealing gas the property of the Portsea Island Gas Company. The theft was committed in the usual way, by bye-passing the meter; and the accused confessed that he had taken the gas because he had seen how to do it in a report of a similar case which he read nine months ago. On his behalf, Mr. G. H. King said Burrows was not an ordinary criminal brought before the Court, but he admitted that, in a sneaking sort of way, he had tried to "do" the Company for a small sum of money. He appealed to the Bench not to take too harsh a view of the case, as a conviction might mean the loss of defendant's Naval pension of £41 a year. Mr. E. Hobbs, for the Company, pointed out that if all the gas appliances in defendant's house were used the consumption would amount to £18 11s. 2d. per annum. While urging the seriousness of the offence, he said the Company did not wish to be vindictive. They therefore suggested that the defendant might be bound over to pay such damages as they had sustained. After deliberating in private, the Bench decided to bind defendant over in his own recognizances of £10 for six months; and, in addition, they ordered him to pay to the Company £5 as compensation, and £2 2s. costs.

Water Supply for Trade Purposes.—Referring to the recent decision of the House of Lords in the Colley's Patents case [*ante*, p. 545], Mr. W. H. Daw, in a letter to "The Times," says: "The Metropolitan Water Board (Charges) Act no doubt contemplated giving manufacturers and traders relief by allowing them to pay for their water in proportion to the amount they consumed, and not upon the rating of their premises, which would have no relationship whatever to the quantity of water they might use in their business. The injustice which now exists could, no doubt, be remedied by the Water Board making regulations to deal with such cases. There should be little difficulty in agreeing when a consumer requires water for the purpose of his trade, manufacture, or business; and the mere fact of the existence of sanitary arrangements which are necessary for all occupied premises should not cause the supply which would otherwise be for business purposes to become a domestic supply. Unless the Water Board are prepared to deal with this subject in a fair and reasonable spirit, it seems imperative that the Legislature should pass an Amendment Act, to give effect to what was undoubtedly the intention, but which has been nullified by the 'barbarous and slovenly language' used. It is also a question whether all water should not be paid for by meter, in the same way as gas or electric light."

Chapel and Whaley Bridge Gas Company's First Year's Working.—In their first annual report and balance-sheet the Directors recommend the payment of a dividend of 3 per cent., less income-tax. It is stated that the works at Chapel and Whaley Bridge have been improved since acquirement. The plant generally has been overhauled, old mains, where necessary, have been changed and new ones put in; and meters and fittings have been installed to meet the growing demand for gas within the Company's supply area. Since the end of the Company's financial year, £20,000 additional capital, in £1 ordinary shares, had been advertised for sale by tender. During the year there had been expended the following sums, omitting shillings and pence: Purchase of the Chapel-en-le-Frith and Whaley Bridge Companies' undertakings, including law charges, £21,576; land acquired and law charges, £567; new buildings, &c., £377; new mains and pipes, including laying, &c., £6375; new meters and fittings, £826; new stoves, fittings, &c., £1169; cost of formation of Company, Act of Parliament, &c., £1911; Gas Act, £3364—total outlay, £34,251. The revenue for the year amounted to £2435 12s. 9d. of which £1388 19s. was for gas sold, and £372 8s. for residuals.

APPLICATIONS FOR LETTERS PATENT.

26,554.—Schier, W., "Shock-absorbing unions for gas-burners." Nov. 27.

26,563.—Crerar, J., and Archibald, J., "Lighting street-lamps." Nov. 28.

26,615.—Palmer, W. V., "Volumetric gas-governors." Nov. 28.

26,661.—Lea, J. W., "Mantle rings." Nov. 29.

26,799.—Fabry, R., "Handling coke." Nov. 30.

26,858.—Thompson, T., "Combination gas stoves and fires." Nov. 30.

26,938.—Hampson, H. W., "Actuating gas-cocks." Dec. 1.

26,951.—Walker, A. B., "Gas and similar radiators, stoves, and the like." Dec. 1.

26,979.—Davidson, W. B, and Liversedge, A. J., "Gas-scrubber." Dec. 2.

26,988.—Little, C. R., and Yarnold, A., "Incandescent gas lights." Dec. 2.

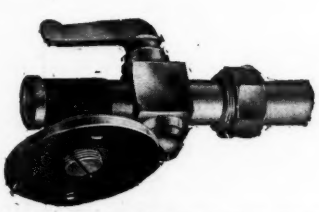
Restoration of Lapsed Patents.

Notice is given that an order was made on Nov. 29 restoring the letters patent granted to George Cecil Dymond, for an invention for "Improvements in incandescent gas-lamps," No. 14,553 of 1900, and bearing date Aug. 4.

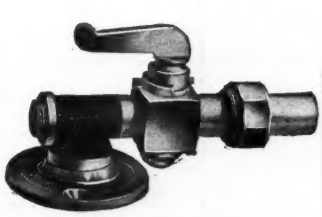
Notice is given that an order was made on Nov. 29 restoring the letters patent granted to William Phillips Thompson, for an invention for "Improvements in incandescent gas-lamps," No. 23,222 of 1900, and bearing date Dec. 19.

Something New!

TWO-WAY GAS FIRE TAP.



USED AS STRAIGHT-WAY TAP.



USED AS ELBOW TAP.

The alteration is made by changing the position of screwed plug.

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NELSON METER WORKS, **MANCHESTER.** RADFORD METER WORKS, **NOTTINGHAM.**

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Agent for Scotland: JNO. D. GIBSON, 2, Causeyside Street, PAISLEY.

Staines and Egham Gas Company.—The report adopted at the annual meeting of the Staines and Egham Gas Company drew attention to the increased sales of gas; it being stated that, in spite of the fact that the price had been reduced by 3d. per 1000 cubic feet since Sept. 30, 1909, the total revenue from gas in the past year showed an increase. The extension of the Company's mains to the parish of Laleham had been completed; and the consumption of gas in this area showed prospects of a satisfactory return on the outlay incurred. The public lighting was much appreciated, and was giving general satisfaction. With a view to further extending the use of gas for heating and cooking purposes, the Directors had arranged for the district to be specially canvassed; and they were now prepared to let out on hire, at a very low rental, a variety of economical gas-fires of the latest designs. The Chairman (Mr. H. Weller) announced that, at a Board meeting held earlier that afternoon, it had been decided to maintain all burners free of charge; and they had appointed two officials to specially attend to this duty and to give free advice to consumers. The report and balance-sheet were adopted; and final dividends were declared of 8¾ per cent. on the original shares and 7¼ per cent. on the additional shares—making total dividends for the year at the prescribed rates of 13¾ and 10¾ per cent. respectively, or an increase of 10s. per cent. over the dividends paid last year.

Gas Scores against Electricity in Coatbridge.—In view of the increasing necessity of reducing costs of production, the following should be of interest to large manufacturers and others. Over twenty-five years ago the firm of Messrs. Stewarts and Lloyds erected gas manufacturing plant at their Clyde Tube-Works, from which they not only obtained the illumination of their extensive works, but also a supply of smithy char. Recently the Directors of the firm have been comparing costs and efficiency results, both in regard to gas and electricity; and they have found it to their advantage to revert to the use of the town gas, supplied by the Coatbridge Gas Company. The high-pressure system of lighting adopted is the same as that used in the recent Glasgow Exhibition; and it is claimed for it that electricity would require to be sold in Coatbridge at the rate of ¼d. per unit, instead of at the special 25 per cent. reduced rate of 3d. per unit, to compete in regard to cost. It is said that the whole capital outlay involved will be recouped in two years by the saving in gas consumption. The Coatbridge Gas Company are to be congratulated in securing in this way an installation which will increase their output of gas by as many millions of cubic feet per annum as is manufactured in many of the smaller towns of Great Britain in the same period. The present charges for gas in Coatbridge are 1s. 7d. per 1000 cubic feet for lighting and 1s. 4d. for power.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Dec. 9. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	per ton	—	21/– 26/–	22/3 26/3	—	22/6 26/–	—
Pitch	,,	42/6	40/9	41/–	40/6	40/–	40/–
Benzol, 90%	per gallon	1/2⅛	–/11⅜	–/11⅛	1/–	–/11½	–/11½
Benzol, 50-90%	,,	—	–/11¼	–/10⅞	–/11	–/10⅝	—
Toluol, 90%	,,	—	–/11⅛	–/10½	—	–/10	–/11
Crude naphtha, 30%	,,	—	–/4⅜	–/4⅛	–/5	–/4⅜	—
Light oil, 50%	,,	—	–/3⅝	–/3⅜	–/4⅜	–/4½	—
Solvent naphtha, 90-160	,,	—	–/10⅜	–/10	—	–/10⅛	–/11½
Heavy naphtha, 90-190	,,	—	–/11⅛	–/11	—	–/10⅜	–/11½
Creosote in bulk	,,	–/3⅛	–/2½	–/2 7/16	–/2⅝	–/2⅝	–/2⅛
Heavy oils	,,	—	–/2⅝	–/2½	—	–/2⅞	–/2¾
Carbolic acid, 60's	,,	2/9	2/6½	2/8	2/6	2/6	2/5
Naphthalene, crude drained salts	per ton	—	44/6	42/6	47/6	50/–	—
,, pressed	,,	—	61/6	63/–	60/–	60/– 75/–	—
,, whizzed	,,	—	—	—	70/– 72/6	65/– 75/–	62/6
Anthracene	per unit	–/1 7/8 –/2	–/1½	–/1½	–/1¼	–/1¼	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 748.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11	200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	125—130	..	4 12 4
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	93—95	..	4 4 3	561,000	Stk.	Aug. 16	10	Liverpool United A.	218—220	..	4 10 11
250,000	5	Sept. 28	7	Bombay, Ltd.	6—6½	..	5 7 8	718,100	,,	,,	7	Do. B.	164—166	..	4 4 4
50,000	10	Aug. 31	15	Bourne- mouth Gas & Water } 10 p.c.	29—30	+½	5 0 0	306,083	,,	June 30	4	Do. Deb. Stk.	102—104	..	3 16 11
311,810	10	,,	7	B 7 p.c.	16¼—16½	..	4 3 7	75,000	5	June 15	6	Malta & Mediterranean	4⅞—5⅛	..	5 17 1
75,000	10	,,	6	Pref. 6 p.c.	14¼—14½	..	4 1 4	560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
380,000	Stk.	Aug. 16	13	Brentford Consolidated	256—261	..	4 19 7	250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
330,000	,,	,,	10	Do. New	198—203	..	4 18 6	541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0	1,775,892	Stk.	July 28	4½	Newc'tle&G'tesh'd Con.	101—102	..	4 5 9
206,250	,,	June 15	4	Do. 4 p.c. Deb.	98—100	..	4 0 0	529,705	Stk.	June 30	3½	Do. 3½ p.c. Deb.	87—89	..	3 18 8
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	217—222	..	4 19 1	55,940	10	Aug. 31	7/7/0	North Middlesex 7 p.c.	14½—15½	..	4 14 10
246,320	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8	300,000	Stk.	Apl. 27	8	Oriental, Ltd.	138—140	..	5 14 4
490,000	20	Sept. 28	12½	British	44½—45½	..	5 9 11	60,000	5	Sept. 28	8	Ottoman, Ltd.	6⅜—7½	..	5 10 4
120,000	Stk.	June 30	4	Do. 4 p.c. Deb. Stk.	94—96	..	4 3 4	31,800	53	Aug. 16	13	Portsea Island A	140—145	..	4 14 10
109,000	,,	Aug. 16	6	Bromley, A 5 p.c.	127—132	..	4 10 11	60,000	50	,,	13	Do. B	133—138	..	4 14 2
165,700	,,	,,	4½	Do. B 3½ p.c.	97—102	..	4 8 3	100,000	50	,,	12	Do. C	130—135	..	4 8 11
89,278	,,	,,	5½	Do. C 5 p.c.	117—122	..	4 10 2	398,490	5	Oct. 12	8	Primitiva Ord.	7⅞—7⅞	..	5 4 11
55,000	,,	June 30	3½	Do. 3½ p.c. Deb.	82—84	..	4 3 4	796,980	5	June 30	5	Do. 5 p.c. Pref.	5½—5⅝	..	4 13 0
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	96—98	+1	4 1 8	488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99*	+2	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—	312,650	Stk.	June 30	4	River Plate 4 p.c. Deb.	96—98	+1	4 1 8
100,000	10	—	—	Do. 4½ p.c. Pref.	4¼—5¼	..	—	250,000	5	Sept. 28	12	San Paulo, Ltd.	10½—11	..	5 9 1
100,000	Stk.	June 30	4½	Do. 4½ p.c. Deb. Stk.	80—83	..	5 8 5	115,000	10	,,	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
157,150	Stk.	Aug. 16	5	Chester 5 p.c. Ord.	111—113	..	4 8 6	125,000	50	July 1	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
1,513,380	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	110—112	..	4 17 7	135,000	Stk.	Aug. 31	10	Sheffield A	239—241	+1	4 3 0
560,000	,,	,,	5½	Do. 3½ p.c. do.	105—107	..	4 19 8	209,984	,,	,,	10	Do. B	239—241	+1	4 3 0
475,000	,,	June 15	3	Do. 3 p.c. Deb. Stk.	76—78	..	3 16 11	523,500	,,	,,	10	Do. C	239—241	+1	4 3 0
800,000	Stk.	May 31	4	Continental Union, Ltd.	88—93	..	4 6 0	90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—137	..	5 2 2	6,429,895	Stk.	Aug. 16	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9	1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2	209,820	Stk.	Aug. 16	8½	South Shields Con. Stk.	155—157	..	5 8 3
840,150	10	July 28	10	European, Ltd.	19½—20½	..	4 17 7	605,000	Stk.	,,	5¼	S'th Suburb'n Ord. 5 p.c.	121—123	..	4 12 0
16,160,600	Stk.	Aug. 16	4/14/8	Gas- light and Coke } 4 p.c. Ord.	104½—105½	+½	4 9 9	60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
2,600,000	,,	,,	3½	3½ p.c. max.	84½—86½	..	4 0 11	117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
4,062,235	,,	,,	4	4 p.c. Con. Pref.	102—104	..	3 16 11	502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	+1	4 11 9
4,531,705	,,	June 15	3	3 p.c. Con. Deb.	80—82	..	3 13 2	120,000	Stk.	Aug. 16	7½	Tottenham A 5 p.c.	145—148	..	4 16 3
258,740	Stk.	Sept. 14	5	Hastings & St. L. 3½ p.c.	94—96	..	5 4 2	483,940	,,	,,	5⅝	and B 3½ p.c.	115—117	..	4 16 1
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—	149,470	,,	June 15	4	Edmonton 4 p.c. Deb.	96—98	..	4 1 8
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	17—17½	..	6 5 9	182,380	10	June 15	8	Tuscan, Ltd.	8⅜—9½	..	8 13 0
131,000	Stk.	Sept. 14	7½	Ilford A and C	154—157	..	4 15 6	149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
65,780	,,	,,	6	Do. B	125—128	..	4 13 9	236,476	Stk.	Aug. 16	5	Tynemouth, 5 p.c. max.	114—116	+1	4 6 2
65,500	,,	June 30	4	Do. 4 p.c. Deb.	94—96	..	4 3 4	255,636	Stk.	Aug. 31	6⅞	Wands- worth B 3½ p.c.	142—145	..	4 14 10
4,940,000	Stk.	Nov. 10	9	Imperial Continental	186—188	+2	4 15 9	85,766	,,	June 30	3	3 p.c. Deb. Stk.	73—75	..	4 0 0
1,235,000	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.	90—92	..	3 16 1								

Prices marked * are "Ex. div."